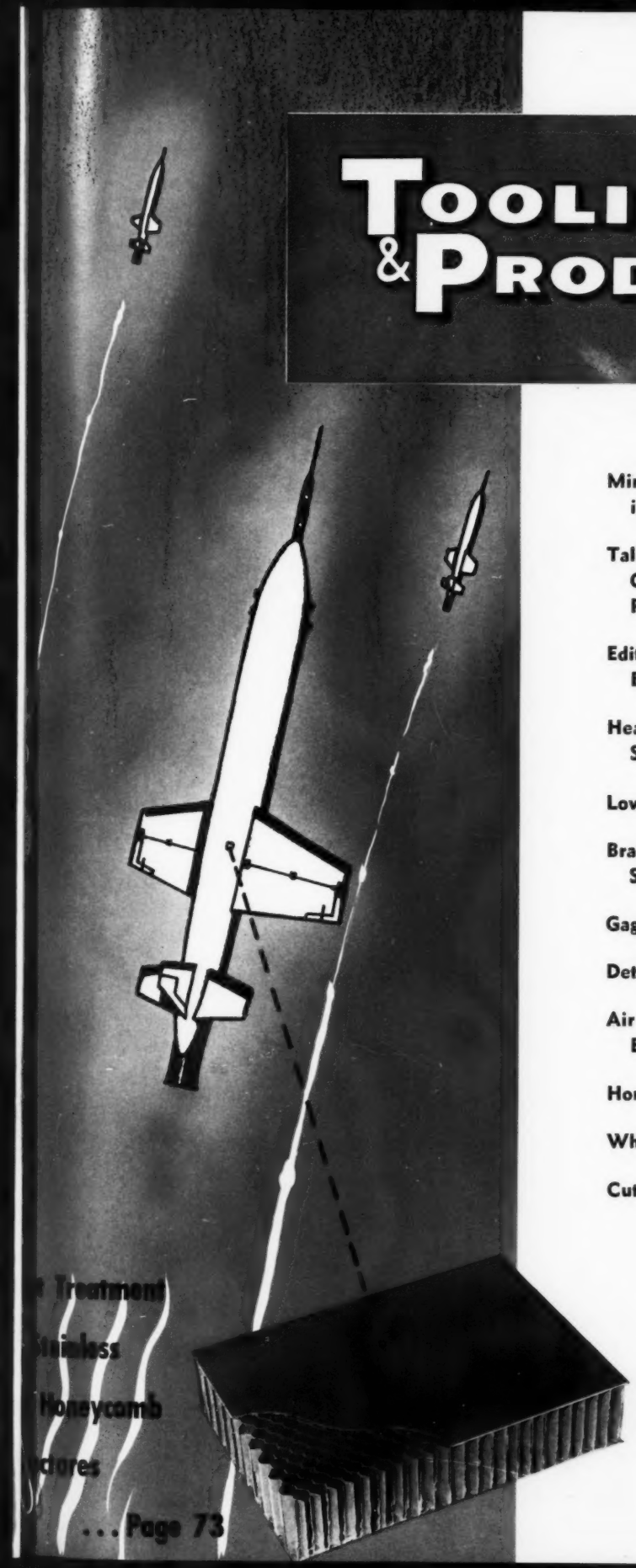
SEPTEMBER 1957

TOOLING & PRODUCTION

Magazine



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3 REASONS WHY SUTTONS ARE THE BEST BUY!

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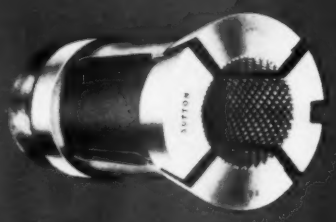
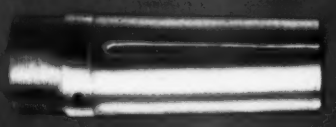


Standard collet for ACME-GRIDLEY, CONE, NEW BRITAIN GRIDLEY, and WARNER & SWASEY AUTOMATIC BAR MACHINES.



Style "L" master feeder with interchangeable and replaceable pads.

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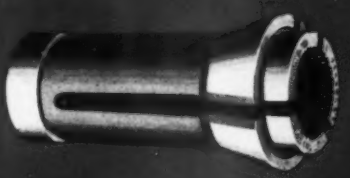
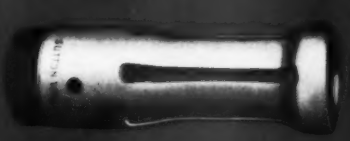


Standard collet for 4 and 6 spindle GREENLEE AUTOMATIC BAR MACHINES.



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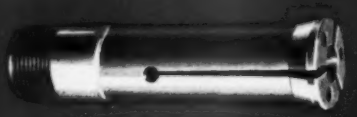

Standard collet for DAVENPORT AUTOMATIC BAR MACHINES.

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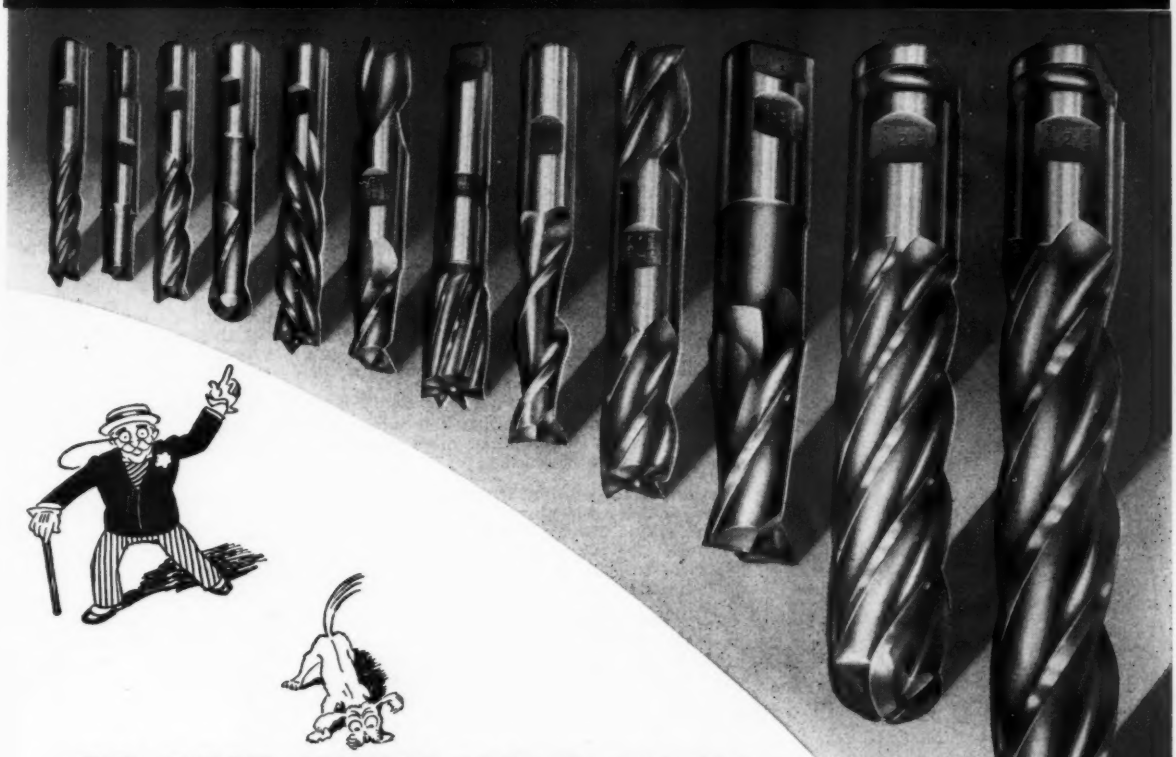

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TOOLING & PRODUCTION Magazine

SEPTEMBER 1957
VOL. XXIII—No. 6
GEORGE J. HUEBNER, Founder

PERSONALLY SPEAKING

Dear T&P Reader:

In our February issue we started something new. I'm speaking of our "Cumulative Editorial Index" for 1957. This was developed in response to an expressed need by our readers for an index of articles by subjects. For good measure we also threw in an author's index so that if you could remember the name of the author, even if you couldn't recall the precise subject of the article, you would be able to get to the right issue easily.

After a few months passed we decided to check to see if the index was filling the need. So some of you were asked about this by our researchers who turned their findings over to us. Apparently the author's index was not being used regularly although the subject matter index was used.

On the strength of this information we dropped the author's index, but we'll continue the subject index for at least the rest of this year. By then, we should know whether we'll continue it or go to a yearly index. It all depends on you. Drop me a line and tell me how you feel about this index.

Speaking of research, as many of you know, we are constantly checking our readers to learn more about their wishes and interests. We do this so that our editors can develop the most interesting and valuable articles for the greatest number of readers.

In addition to personal interviews we also conduct mail surveys. The most recent of these was started on July 17. "Wats" Nordquist, our Managing Editor, sent out 500 questionnaires to a cross section of our readers and by August 1 he had received 40.6% response. It was a long questionnaire designed to help us develop an accurate picture of the job responsibilities of our readers.

As you see, the response was phenomenal. And the answers are still coming in. This space doesn't permit me to tell you all of the answers but, so far, the ten most often checked responsibilities of the 103 listed were: Advance Planning, Labor Relations, Machine Replacement, Tool Design, Cost Reduction, Jig & Fixture Design, Machine Design, Methods, Die Design and Cost Estimation.

If you'd like to know about the rest, drop me a line.

Our worthy Managing Editor, "Wats" Nordquist, joins me and our entire staff in saying "Thanks" for your splendid cooperation.

Cordially yours,

Ray Huebner

Publisher

TOOLING & PRODUCTION

READERSHIP RESEARCH — BPA

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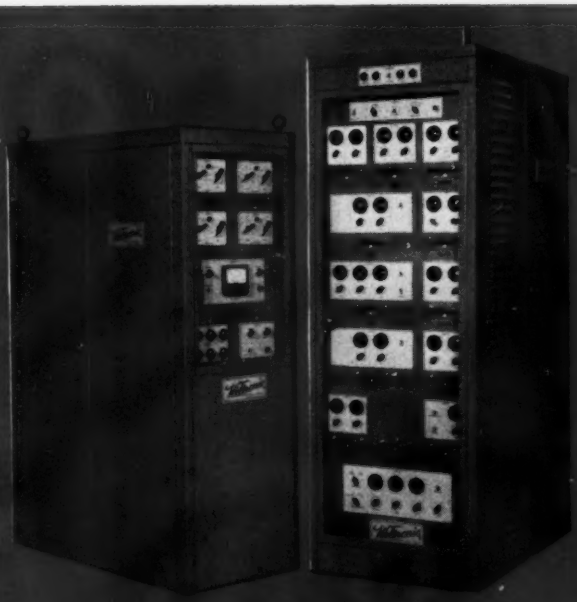
EXCLUSIVE "SET-UP/RUN" SWITCH

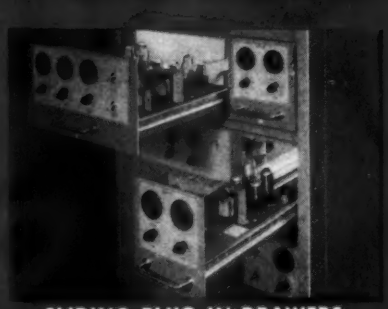
This exclusive feature allows instant, visual check-out of all timing circuits, before an actual run, and, without the use of any special test instruments—ever!

SEPARATE HEAT CONTROL PANELS

There's one for each of the various heat functions, such as preheat, weld, postheat and current decay. These heat control panels are interchangeable, too!

*Trade Mark of Weltronic Co.





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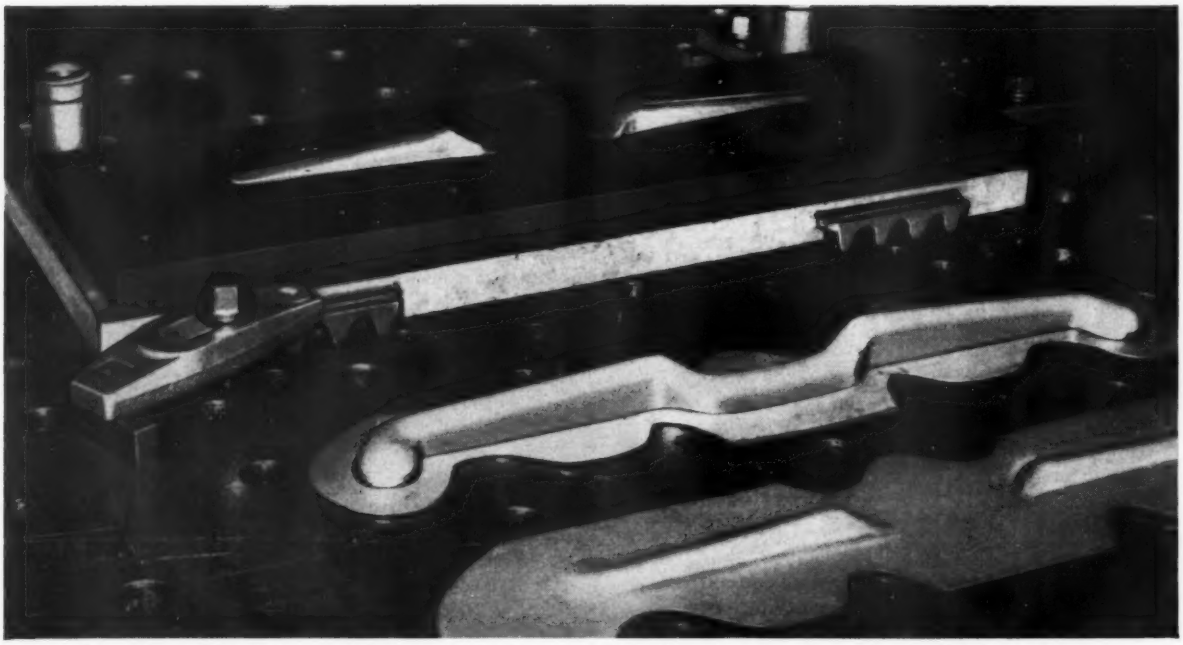

One of four UHB-151 dies made by D. P. Metal Products, Inc., Brooklyn, N. Y.—with samples of steps two and three.

UDDEHOLM Tool Steel Versatility Helps Make Jet Engine Parts

Hydraulic Press on which manifolds are formed.

Here's a good example of how tool steel versatility—as well as high quality—can do an important job for industry. B. H. Aircraft Company, Inc., of Farmingdale, N. Y., uses four dies to turn out heavy gauge Stainless Steel manifolds for Pratt & Whitney Aircraft J-57 jet engines. There are four operations—two draws, restrike and final trim. All four dies are made of Uddeholm's air-hardening UHB-151. Demands on the tool steel are really severe. Tolerances on these vital parts are close—so that non-deformity in hardening of the tool steel must be excellent. In addition, the tool steel must combine both high wear resistance and toughness. UHB-151 met these varied demands on every count. A quote from one of B. H.'s engineers is typical: *We know we can always depend on Uddeholm's quality. What we also like is their quick delivery and readiness to supply information and assistance whenever we need it.* Uddeholm's fine Swedish quality tool steels can do a similar job for you—whatever your requirements. Air-, oil- and water-hardening types are available in endless combinations of size, shape, grade and finish. For quick delivery or information, just phone your nearest Uddeholm office or representative.

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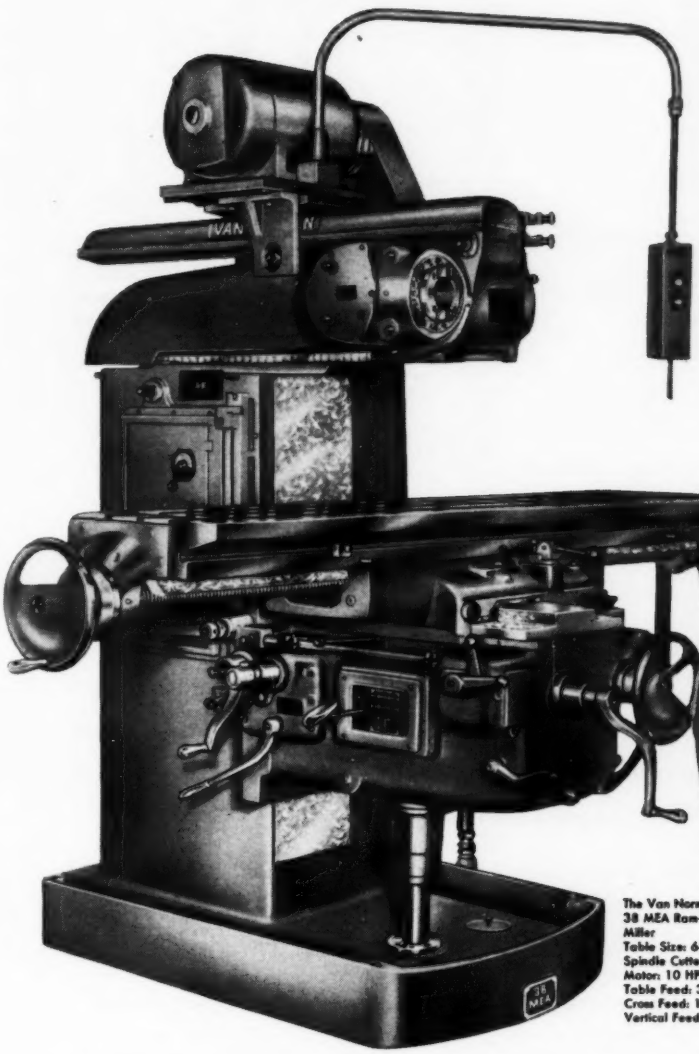
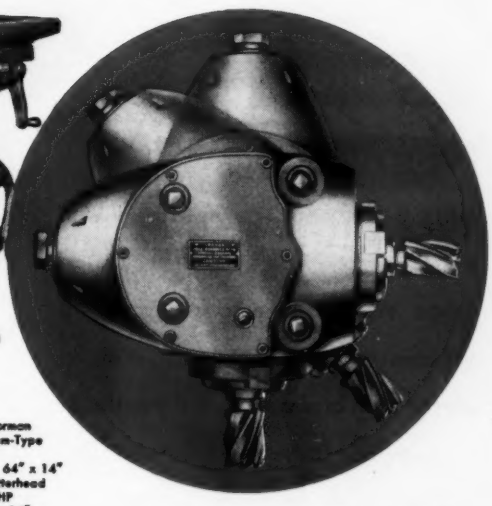
CIRCLE INFORM-A-GRAM KEY NO. 6

One Van Norman
RAM-TYPE MILLER

Saves You Investment Dollars, Cuts Milling Costs, Boosts Production



The Van Norman
38 MEA Ram-Type
Miller
Table Size: 64" x 14"
Spindle Cutterhead
Motor: 10 HP
Table Feed: 34"
Cross Feed: 14"
Vertical Feed: 24¼"



This Van Norman adjustable cutterhead eliminates the need for two single purpose millers.

You can substantially cut the size of your investment and, at the same time, increase your production and reduce milling costs — all through the purchase of *one* Van Norman Ram-Type Miller.

Available for all types of work, Van Norman Ram-Type Millers permit horizontal, vertical and angular milling without attachment — they reduce idle machine and operator time.

Get complete details on the Van Norman 38 MEA, or on any of the many Van Norman Ram-Type Millers. Write, wire or telephone for catalog.

Don't wait . . . for extra profit install a Van Norman machine now! They are available on many purchase plans . . . Outright sale . . . Purchase on conditional sales contract up to five years . . . Pay as you depreciate up to 10 years. Conditional Sales Contracts not available to Export.

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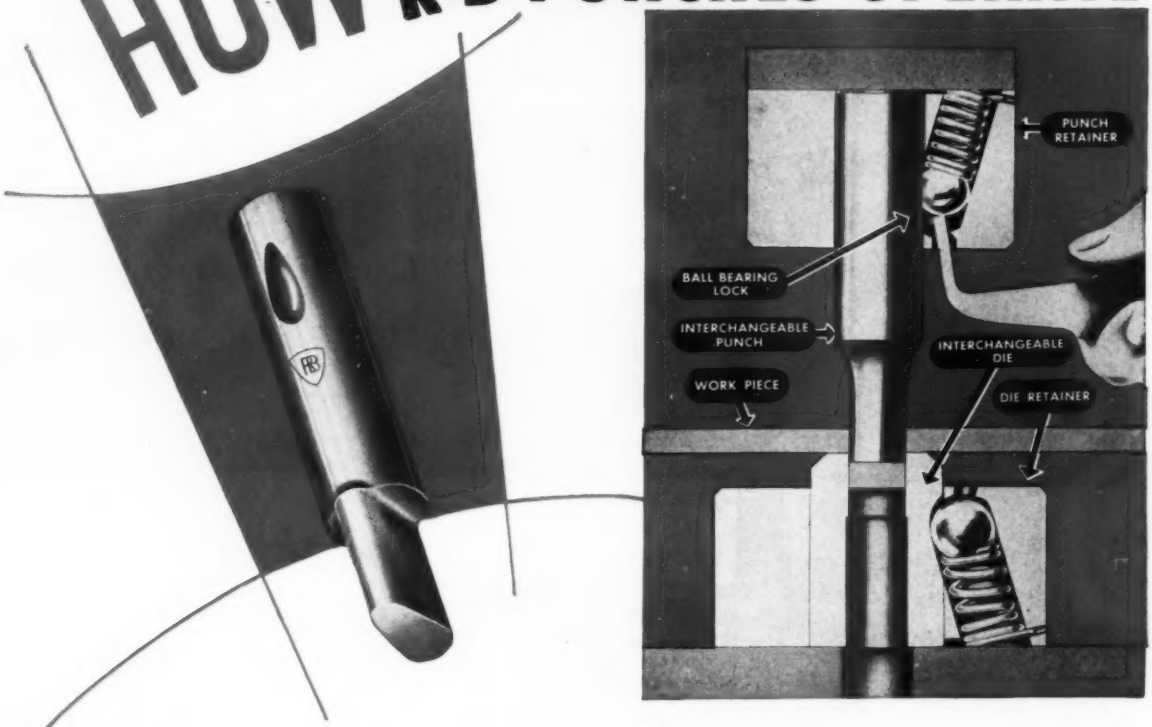

All R-B retainers are equipped with spring-loaded locking balls which engage the recessed portion of R-B punches and die buttons. With a simple push and a twist, R-B standardized punches and die buttons are locked in their retainers . . . they are also instantly removed. R-B punches and die buttons are always accurately aligned—no additional keying is required.

No other manufacturer of punches and die buttons can offer you the amount of successful application experience and the scope of knowledge that is available from the R-B engineering staff for:

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- ★ Increasing Productivity of Presses
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CIRCLE INFORM-A-GRAM KEY NO. 8

Let's CUT COSTS

on these Secondary Operations

- DRILLING
- REAMING
- TAPPING
- TURNING
- MARKING
- PUNCHING
- GRINDING
- ROUTING
- SAWING
- THREADING

High cost second operations can kill first operation profits. If you perform any of the above secondary operations, better take a critical look at how you do it. There may be cost saving opportunities you've overlooked.

If any one of them involves hand feeding of parts or tools—hand clamping—or mechanical means of performing push, pull or lift motions—The Bellows Co. can save you money.

The Bellows Air Motor and the numerous Bellows packaged pneumatic work units can, in a few minutes, transform hand operated machines and machine tools into fast automatic or semi-automatic production units. They are inexpensive to buy—your own tool room can install them quickly.

Here's how to start—

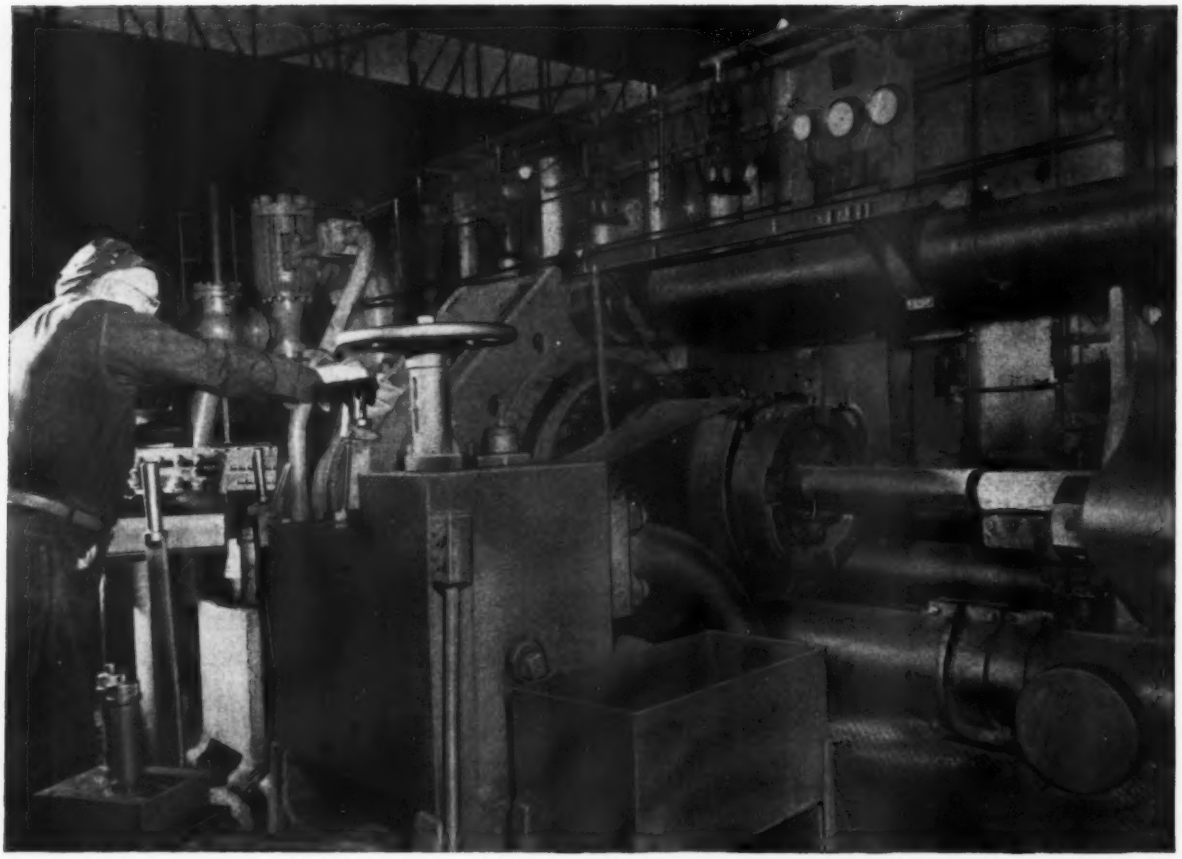
Write for these two booklets. Bulletin ML-3 and BM-25 will give you a quick picture of what others are doing—of what you can do—in cutting second operation costs. Write Dept. TP957, The Bellows Co., Akron 9, Ohio. In Canada: Bellows Pneumatic Devices of Canada, Ltd., Toronto, Ontario.

The Bellows Co.

AKRON 9, OHIO

894-B

CIRCLE INFORM-A-GRAM KEY NO. 9



2,750-ton Loewy press equipped with Carboloy chrome carbide dies reduces 8"-diameter brass billets to 400 feet of .441" rod.

Press downtime reduced 80%...

HOT-EXTRUSION BOTTLENECK BROKEN BY CARBOLOY® CHROME CARBIDE DIES

Carboloy cemented chrome carbide is harder than the hardest die steel. It is far more wear resistant and has excellent oxidation resistance, even at temperatures up to 1,800° F. These and other unique physical properties made chrome carbide an ideal die material for solving the production problem, caused by rapid wearing of steel dies used to hot-extrude brass rod, at Mueller Brass Co., Port Huron, Michigan.

Before switching to chrome carbide, unpredictable product size and varying hardness made it necessary to change steel dies frequently. Downtime bottlenecked production rates, and prevented Mueller from getting maximum efficiency from their automated line.

Today, one Carboloy chrome carbide die does the work of 20 steel dies in extruding .441"-diameter free-machining brass rod. Tolerances are constantly held to ±.006". Production is at a new high, and downtime has been cut 80%.

Carboloy *chrome* carbide may be the economical solution to your hot-extrusion problem. Carboloy *tungsten* carbides may bring similar benefits to your other die operations . . . whether you're cold-extruding, drawing, forming, or blanking. Ask your diemaker about them. Or for more information, and technical assistance, write: *Metallurgical Products Department of General Electric Company, 11111 E. 8 Mile Blvd., Detroit 32, Michigan.*

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GENERAL ELECTRIC

CIRCLE INFORM-A-GRAM KEY NO. 10

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Here's a new machine that will do all these jobs...and more

...anywhere!

The Dumore Versa-Mil is a compact, rigid design, comparatively light weight, *portable* precision machining unit. It performs with extreme efficiency at any angle in any required position or direction, as an independent unit with its own power and feeds, or added to machine tools—lathes, planers, shapers, millers, grinders.

It maintains close tolerances while removing metal at profitable rates on work situated on standard machines, fixed machinery in place, pieces in fixtured set-ups and on parts too big for standard machines. It gives *you* the advantages of machining where it is most economical!

It would pay you to get all the facts about this versatile, new machine tool. Find out all the things it can do and the economies it can give you . . . send the coupon *NOW!*

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DUMORE
VERSA-MIL
PORTABLE PRECISION MACHINING
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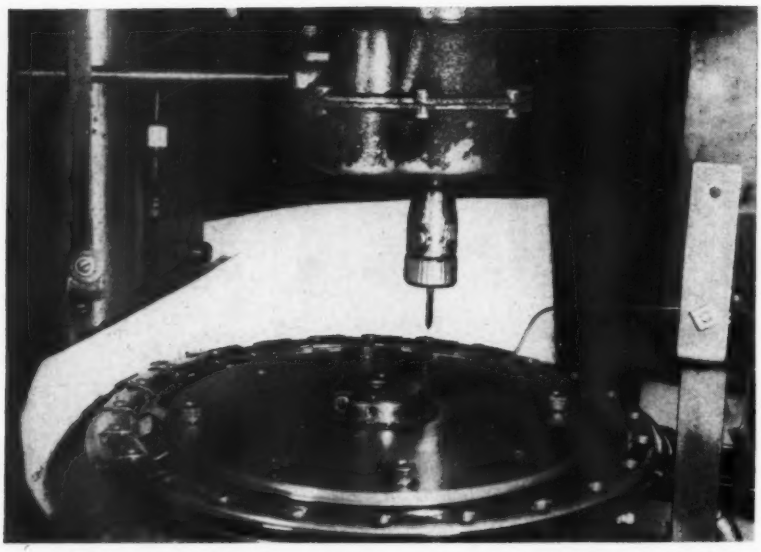
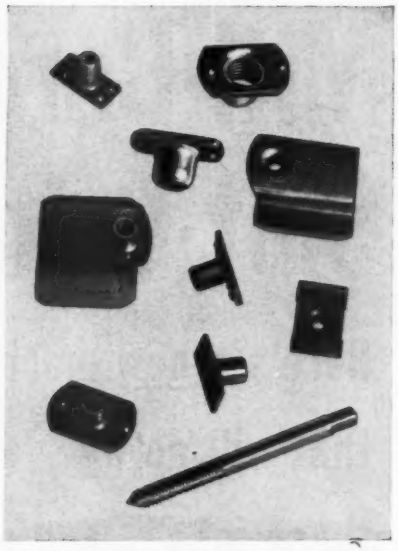
CIRCLE INFORM-A-GRAM KEY NO. 11



THIS AUTOMATIC MACHINE taps 2900 parts per hour with Besly 8-32 NC Spiral Pointed Machine Screw Taps. An air indexed circular feed table moves parts into position, down comes the tap, up goes the tap and on to the next piece — all automatic except placement and removal of parts.



SMALL PARTS finishing is the busines of Keades, Inc. Included are "T"-nuts, bolts, rivets, clips, pins — primarily for the automotive industry. Note Besly 8-32 NC Spiral Pointed Tap right.

BESLY 8-32 NC SPIRAL POINTED TAP . . .

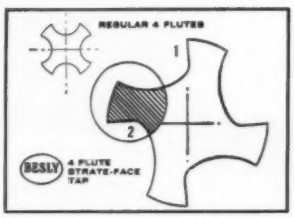
"The Touchstone of Success"

says LEN KEAST of KEADES, Inc.

To increase sub-contract work, Keades, Inc., Wyandotte, Mich., needed a tap to thread small parts in an automatic production machine. Since most taps available failed on the job they called on Besly's Engineering Service for a solution to the problem.

Besly Engineers designed the Besly 8-32 NC Spiral Pointed Machine Screw Tap as the answer. The spiral point on this tap causes it to cut with a shearing action which deflects chips out and ahead of itself. Chips do not accumulate thus eliminating tap lag and breakage. Shallow flutes permit a thicker and stronger tap which gives longer service life. These features, assured Besly Engineers, provide a tap which can operate at higher speeds and less driving power—especially good news to Keades.

Keades now operated two automatic machines, of their own design—shown above, equipped with Besly 8-32 NC Spiral Pointed Taps which thread 2900 pieces per hour at very close tolerances. Each tap lasts 16 hours. This compares to 1500 pieces per hour with taps lasting only 4 hours, by former methods. Savings now amount to $70 per 200,000 parts.



NEW "STRATE FACE" TAP FOR CAST IRON

Designed for freer cutting, more accuracy, longer tap life and less tap breakage. Features — (1) straight cutting face ("Strate Face") has accurately controlled rake angle, (2) new flute and core design with high strength zone makes stronger tap, (3) "Stemite" coating prevents abrasion, stops welding, adds lubricity. Available from No. 6 to ¾" for cast iron tapping only.

ASK YOUR DISTRIBUTOR FOR NEW TAP CATALOG 801, or *write* . . .

Engineering, Service and Specials . . . are a Besly Specialty

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"For VERSATILITY FLEXIBILITY and ACCURACY you can't beat a . . . BULLARD H.B.M." MODEL 75

This statement, by the Planning Engineer of a Midwestern manufacturer of Diesel locomotives, sums up their experience with a 5" Bullard H.B.M., Model 75 after months of use.

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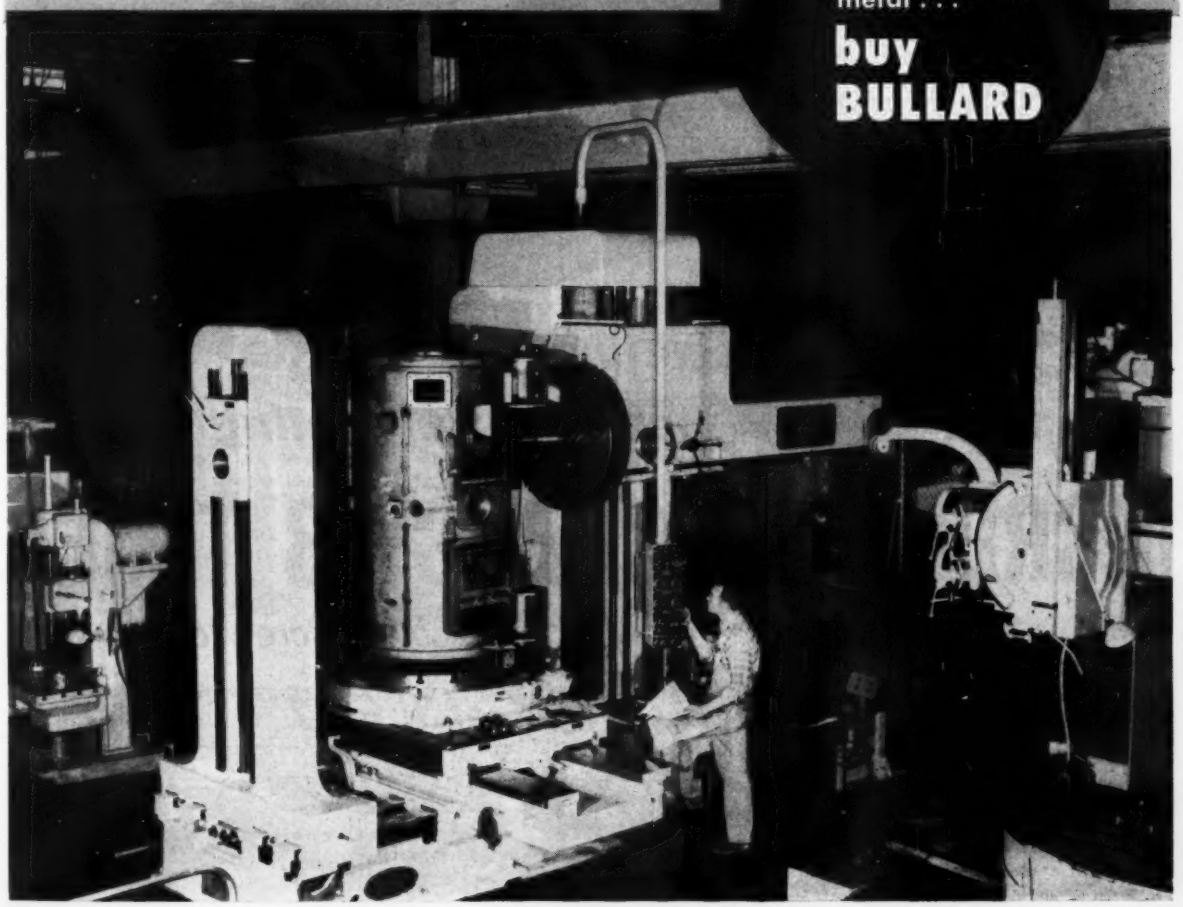

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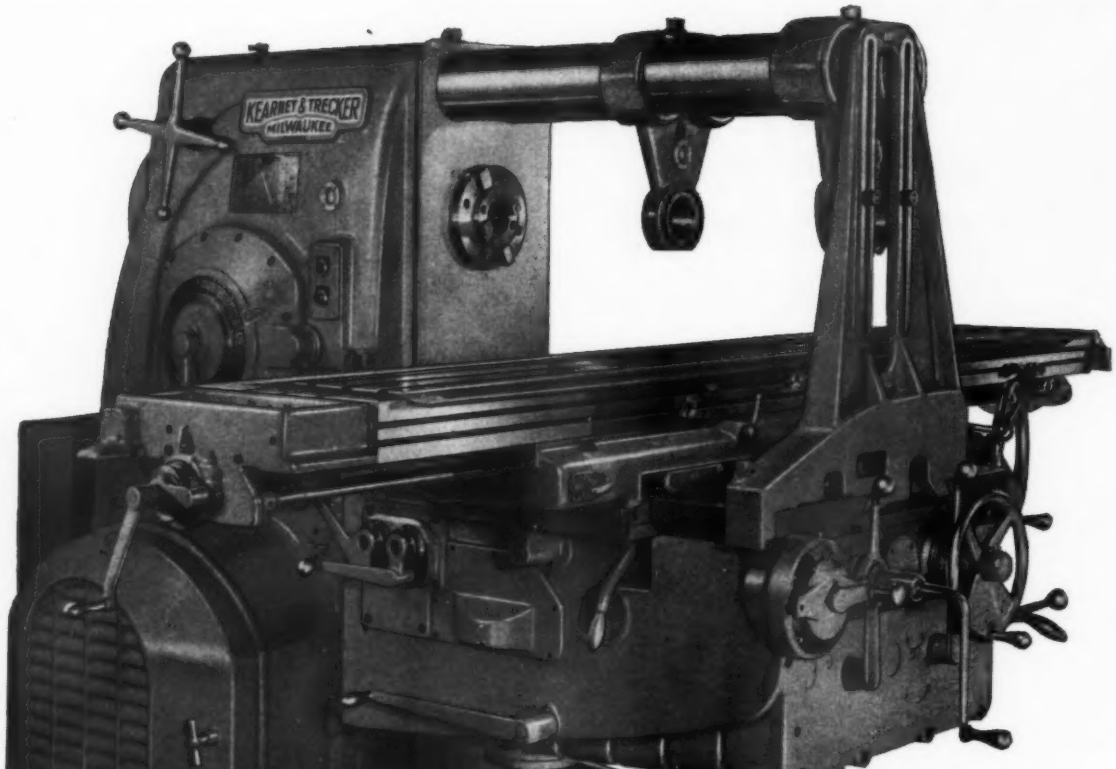

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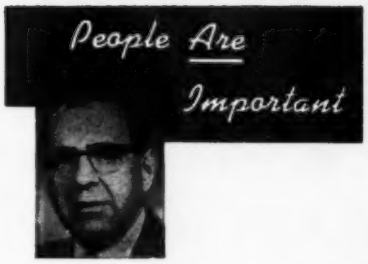

by Erwin K. Taylor, Ph. D.
President
PERSONNEL RESEARCH AND
DEVELOPMENT CORP.
Cleveland 20, Ohio

MINIMIZING EVALUATION DEFICIENCIES

IN THE AUGUST ISSUE of *T&P* we outlined a rather elaborate procedure for establishing the foreman selection process to minimize evaluation deficiency and insure to the maximum extent that all important facets of the job are covered in the best possible manner. Not all managements will want to invest either the time or the money required by the program described. Much, however, can be accomplished short of an all-out effort. Possibly the most important advice is not to depend on any *single* selection means. Convenience or the existence of certain data frequently carries a disproportionate importance with respect to the role that it should play in supervisory selection. Almost any evaluation in which too much or exclusive dependence is placed on a single technique is likely to be deficient.

Where periodic performance evaluation or merit rating of hourly workers is employed for supervisory selection, there is frequently a tendency to place too much emphasis on these. This is particularly unfortunate when the merit rating was designed to reflect performance on a machine rather than predict performance as a foreman. Similarly an organization that routinely collects aptitude, ability, or personality test data may be inclined to depend too heavily on these, while another using the panel interview for supervisory selection may be inclined to ignore the information that could be derived from other sources.

Despite the claims that you may occasionally hear to the contrary, there is no one technique that will come anywhere close to predicting performance in the many facets of the job of a first line supervisor. The best way to minimize evaluation deficiency is to come at the evalua-

. . . Continued on page 17

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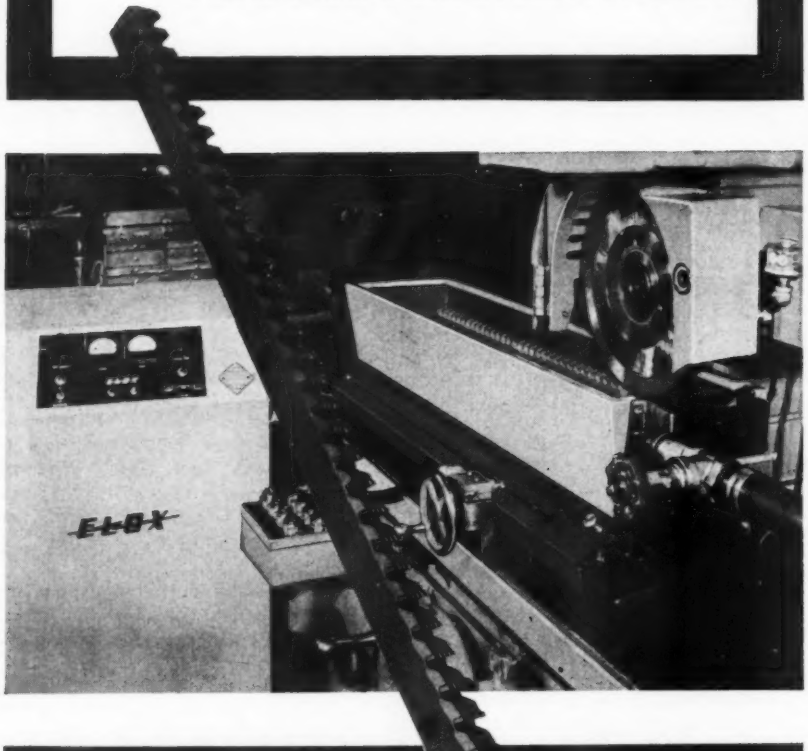
Ford Motor Aircraft Division



Savings on preformed carbide blanks.....	$ 32.00
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Sums up to.....	$294.00

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Broach, used for broaching the pine tree form on turbine blades of the J-57 Jet engine.

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Conventionally machined, the pine tree broach requires 22 operations. EDM does it better in 14.

Electrical Discharge Machining has reduced the machining time of this intricate form in 32 carbide tipped teeth to a total time cycle of 33 minutes . . . one-half the time of abrasive grinding. Tolerances held to: +0, —.0002".

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. . . Minimizing from page 15

tion task by making use of a variety of approaches. Among the evaluation devices that merit consideration, we can list the following:

1. Personnel history, educational and work experience data
2. Psychological tests of aptitude and ability
3. Routine personnel records
   a. Attendance
   b. Safety
   c. Discipline
4. Production and earning records
5. Outside activities
6. Periodic performance evaluations
7. Special reviews (interviews)
8. Professional assessment

Problem of Importance

The third major category of evaluation bias concerns the relative importance of the various facets of a supervisor's job. Unfortunately, in most cases those aspects of supervisory performance which are most important to success are the most difficult to predict. Those things which are most predictable are frequently relatively unimportant. This frequently leads to a situation in which we base our selection much more on the trivial facets of the supervisor's job than on the really important ones.

If the job is attempted on the basis of the opinions of members of higher management, it is quite likely that there will be as many opinions as there are participants in the decision-making group. One approach to solution of the problem has been the suggestion that we attempt to reduce job performance to a cost accounting system.[1] However, the problem of putting a dollar tag on everything a foreman does or for that matter fails to do is in itself an extremely involved process. To all intents and purposes then, cost accounting performance evaluation must still be considered in the realm of the theoretical rather than the practical. For operating purposes we are going to continue to be guided by the consensus of the members of higher management and necessarily with fairly rough approximations which are an improvement over sheer guesswork or assignment of importance by accident or default.

There is still another complicating factor that has a bearing in this realm. From the prediction point of view, the amount of weight to be assigned a given work area is not exclusively a function of its importance to over-all success. The predicted variability in the applicant population constitutes another important facet.

Suppose it was decided that for a given supervisory job the ability to settle grievances at the first echelon

[1]Brogden, H. E. and Taylor, E. K. "The Dollar Criterion." PERSONNEL PSYCHOLOGY, 1950, 3, pp. 133-154.

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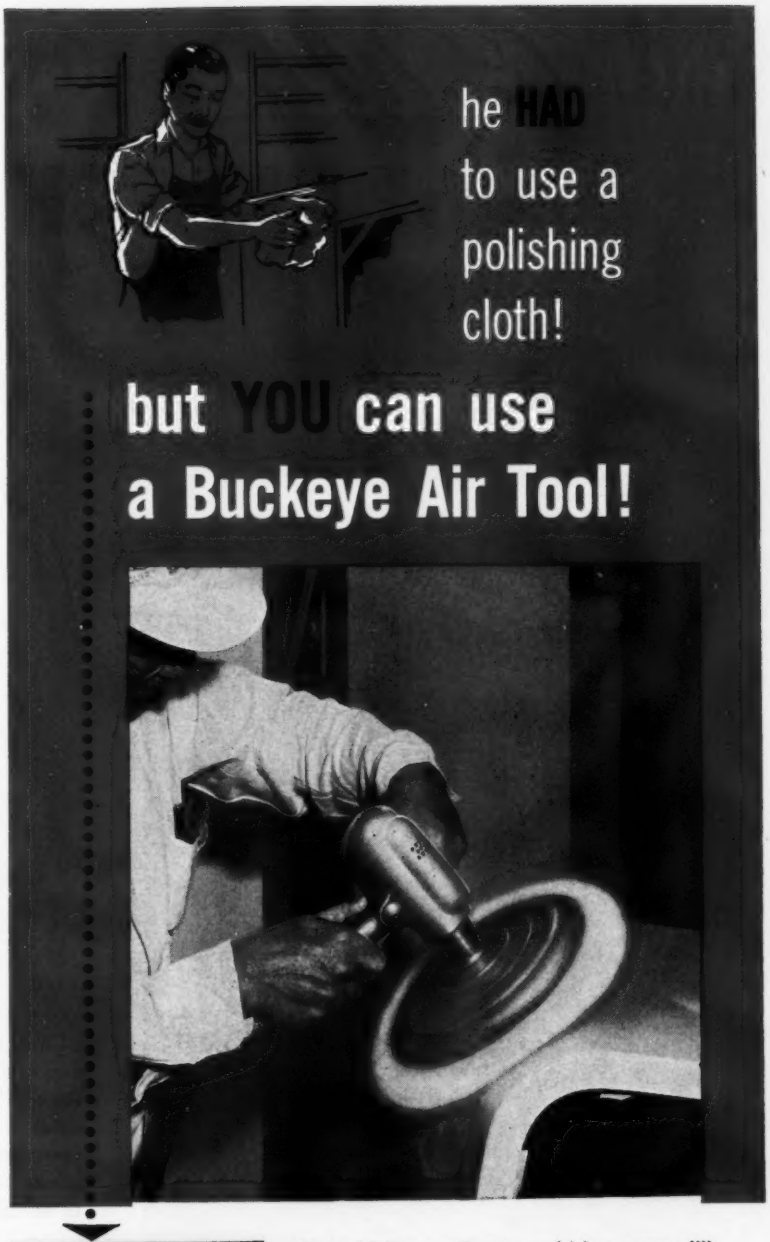

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The old line craftsman, rubbing away diligently with his polishing cloth, took a great deal of pride—and a great deal of time—in his work. The modern craftsman, guiding a compact, lightweight Buckeye polisher or buffer, takes just as much pride in his work, and accomplishes far more in much less time. Mass production and pride of craftsmanship still go hand in hand, with modern Buckeye air tools.

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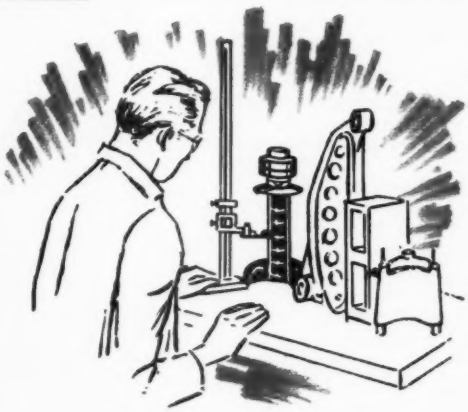
This Cadillac 6" PLA-CHEK GAGE *IS ACCURATE* to .00005"



Cadillac PLA-CHEK

For checking smaller jobs, gages, tools and dies, this portable 6" Cadillac PLA-CHEK Gage is accurate to .00005". It can easily be checked in and out of your tool crib to be used on the surface plate or at the machine. It is completely self-contained and extremely simple in operation. Speeds inspections from minutes to seconds.

Capacity of the 6" PLA-CHEK model can be increased by the addition of a 6" riser without affecting accuracy or sacrificing portability. Send coupon TODAY for complete details!

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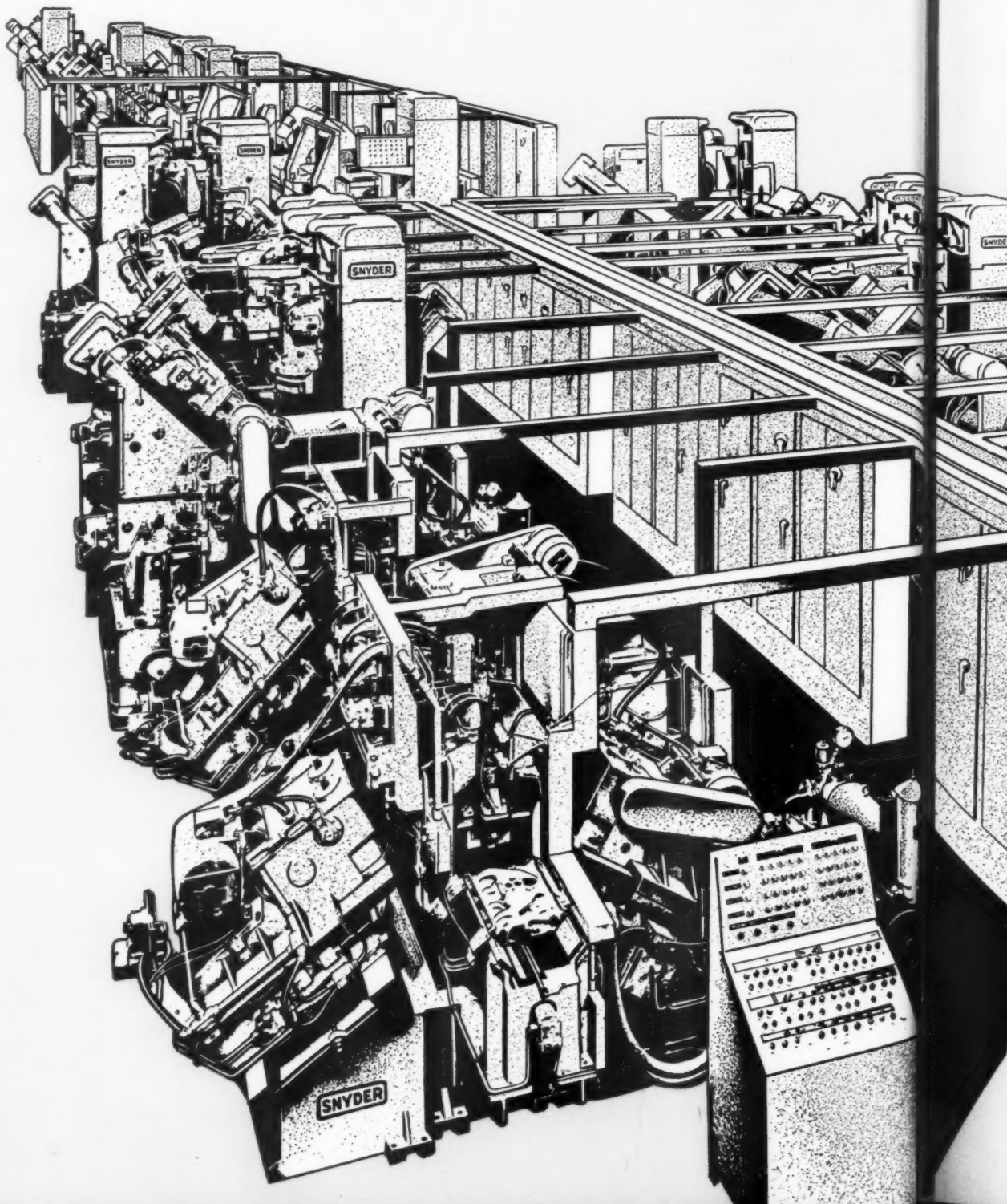

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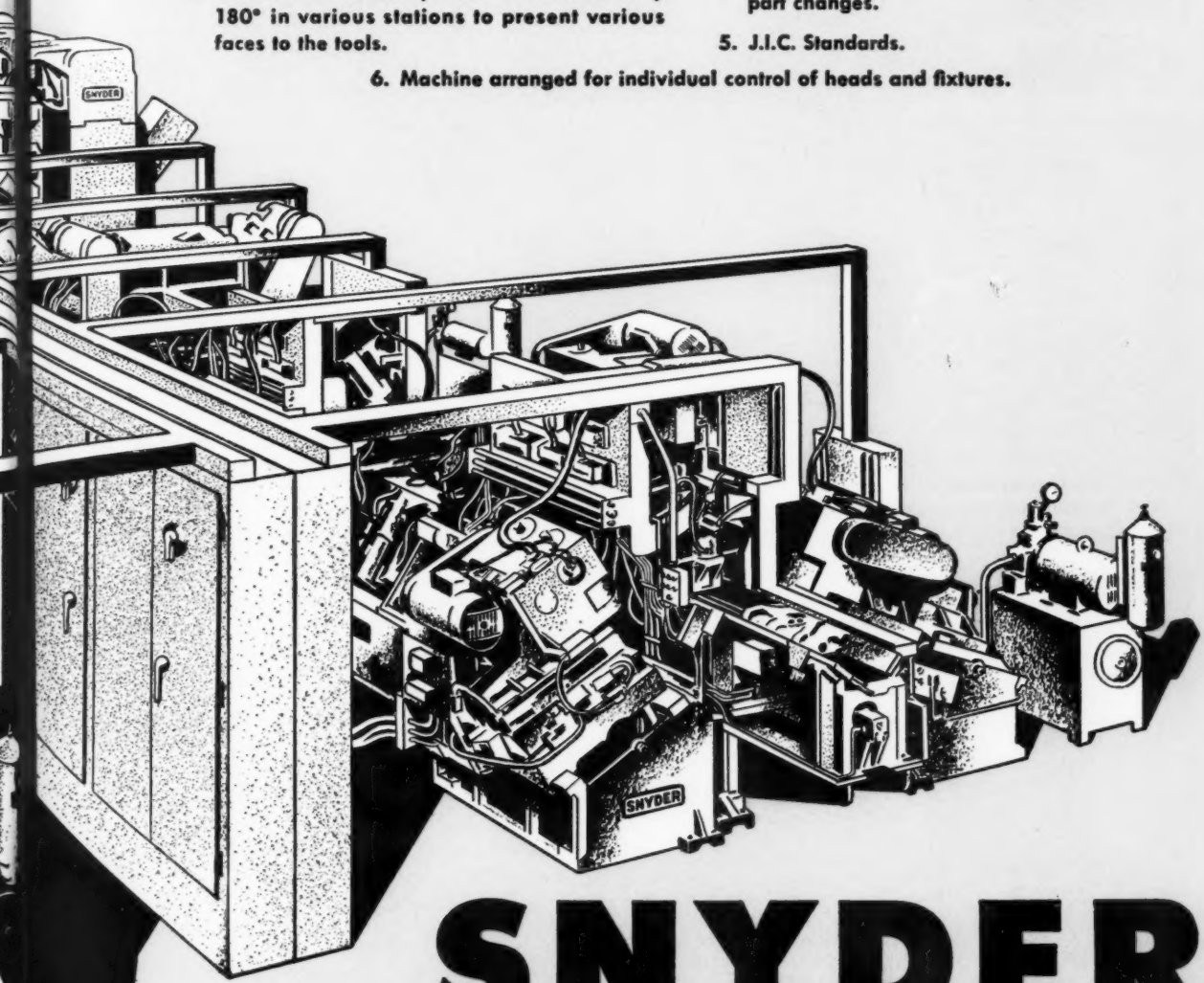

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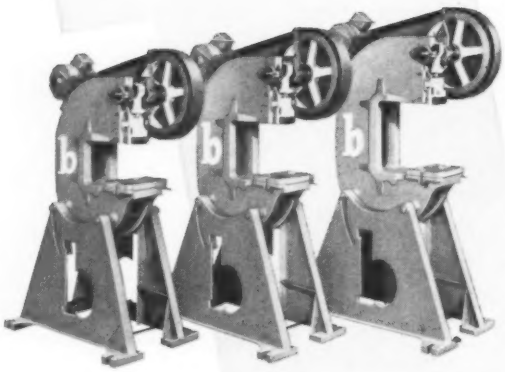

NEW BENCHMASTER 10 TON DEEP THROAT PRESSES Series 100

Available in 3 new models with standard strokes of 1¼". Other strokes available from 1½" to 3". Center of slide to frame 12". Shut heights are obtainable from 7" to 13" depending upon model number and stroke length desired.

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PRESSES: Benchmasters are available in 2, 5, 8 and 10-ton capacities in the following types: Plain OBI, Deep Throat, Fixed-Bed Gap Frame, Back Geared, Half-Press and Multiple Ram.

MILLS: Benchmasters quickly convert from horizontal to vertical milling by exchanging spindle quill assemblies. Precision performance at minimum cost!

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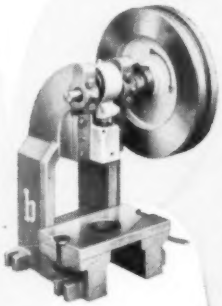
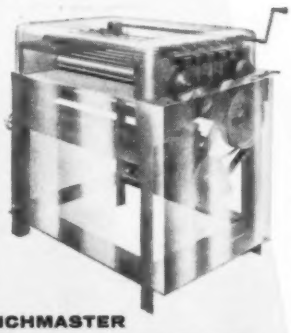


BENCHMASTER 2 TON FIXED-BED GAP FRAME PRESSES

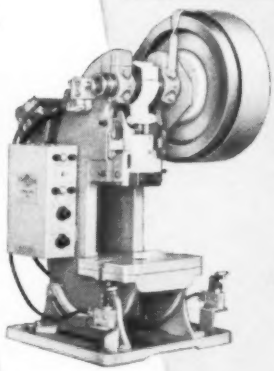
A new Benchmaster with a 4½" column spacing for feeding foil and other wide materials! For fast, efficient light manufacturing or assembly. Typical Benchmaster quality...adjustable gibs, improved sliding key-type clutch, husky frame, replaceable bronze bearings, etc.

NEW BENCHMASTER STRAIGHTENING MACHINES

Now furnished in several series with choice of 9 or 11 rolls for handling all types of coiled stock from soft aluminum to tempered steels. Roll widths up to 36". Thicknesses up to .200". All models equipped with pinch rolls at feed or feed and discharge ends. Also available with or without magnetic clutch and brake.

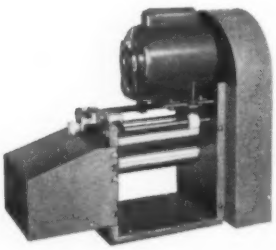


BENCHMASTER ELECTRO-MAGNETIC CLUTCH



Insures instant pickup or disengagement at any portion of the stroke. Permits application to flying cut-off operations or automation of several presses from a single control source. Smooth and relatively noiseless, no sliding keys, no breakage hazards due to shock, excellent safety. Controls for manual, foot, 2-button hand, remote or automatic operation.

NEW BENCHMASTER AUTOMATIC MOTORIZED FEEDS



Equipped with new Benchmaster Electro-Magnetic Clutch and Brake, can be used with presses, shears, etc. Built-in electric measuring device feeds any required length before automatic shut-off. Also available with external microswitch and fixed stop for automatic shut-off. Roll widths up to 36", thickness capacity ⅛". Other specifications on special order.

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Big production booster for all machines feeding coil stock. Supplies a slack loop from which any machine can freely draw without pulling against the weight of a heavy coil. Equipped with Benchmaster's Variloop control which eliminates constant motor starts and stops, insures longer life. Can be supplied in Koil-Kradle Straightener Combinations.

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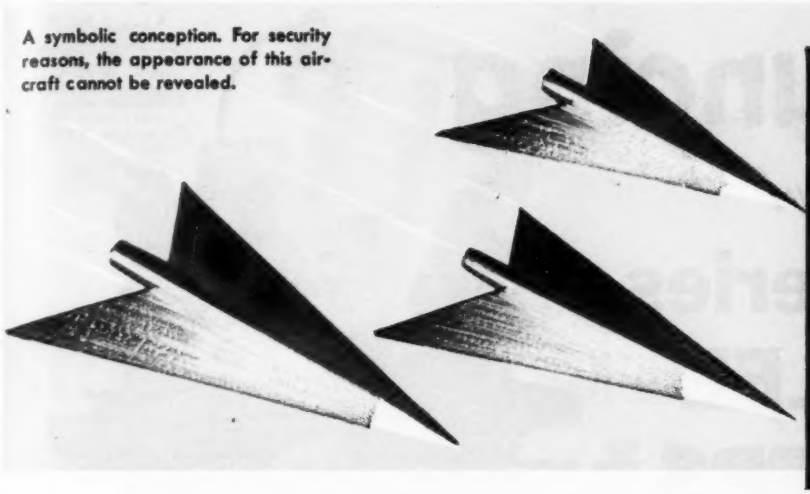
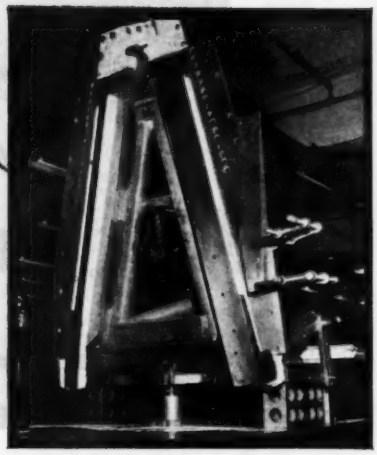


A symbolic conception. For security reasons, the appearance of this aircraft cannot be revealed.



A master drill and setting gauge, showing use of Epon resins to duplicate compound curves and contours.

In building the supersonic Arrow . . .

Avro Aircraft, Limited saves time and money with

EPON® RESIN

dies, tools, jigs, molds and fixtures

Avro Aircraft, Limited—developing Canada's supersonic Arrow—is achieving major savings with Epon resin tooling.

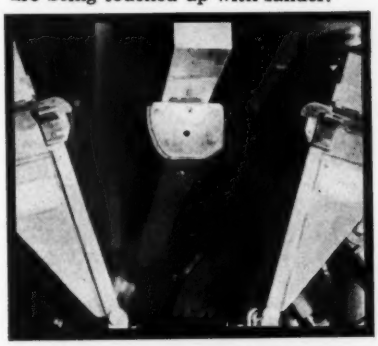
Epon resins provide faster, lower cost preparation of stretch dies, forming tools, drop hammer dies, jigs, duplicate master die molds, checking and assembly fixtures. Avro reports that in making dies of Epon rather than metal, manpower requirements are two-thirds less, which is reflected in correspondingly great savings in the unit cost of tooling.

The Epon resins have an ideal combination of properties for tooling applications. To list just a few:

- Exceptional dimensional stability, high impact strength, excellent resistance to abrasion, minimum residual stress in cured parts.
- Ease and speed of preparation.
- Low shrinkage in filled formulations, assuring perfect master reproduction; minimum warping and stresses.
- Adaptability to repairs and design changes.
- Minimum finishing requirements for smooth surfaces.

Like Avro, other leading manufacturers report savings as high as 80% with Epon resin tools and dies—for *production* as well as experimental and short-run work. Can you make comparable savings in your own operations? Find out by writing for technical literature on Epon resins for tool and die applications.

Epon-faced die requires only hand rubbing to achieve smooth finish. Radii are being touched up with sander.



Stretch die, with Epon resin facing of involved contours, ready for run on 800-ton press.

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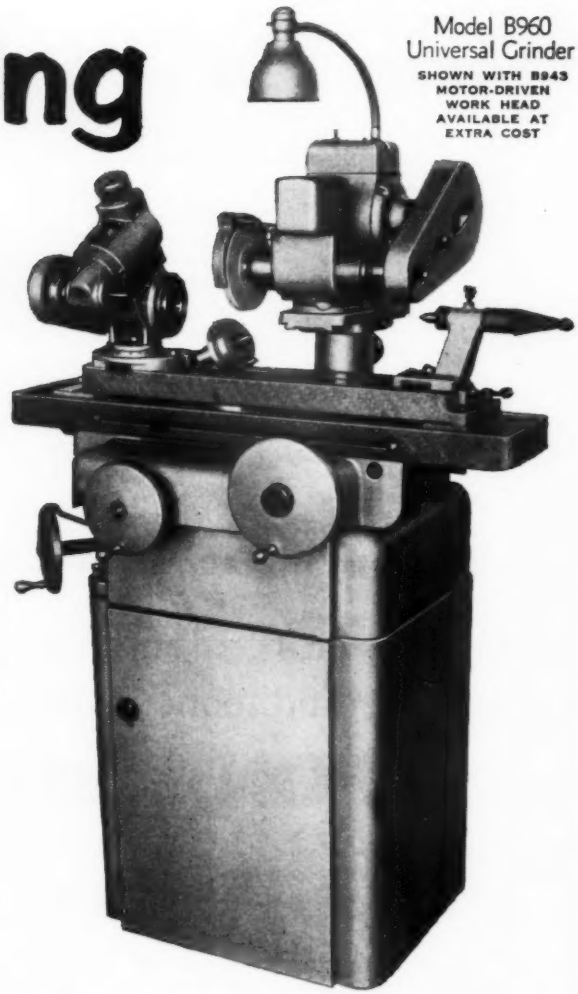
B900 Series K. O. LEE GRINDERS



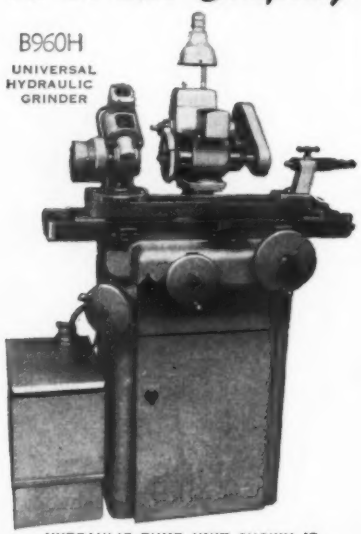
Model B960
Universal Grinder
SHOWN WITH B943 MOTOR-DRIVEN WORK HEAD AVAILABLE AT EXTRA COST

The new Lee grinders have improved accuracy standards, greater capacities, 25% heavier construction, V-type Saddle, larger table ways, improved lubrication system giving longer life, and many refinements for easy operation. New engineering features simplify and minimize time in making setups for almost every operation.

Available Models

B900 Tool & Cutter Grinder
B900X Basic Tool Grinder
B960 Universal Tool Grinder

K. O. Lee Company Offers a Complete Line of Grinder Fixtures



B960H
UNIVERSAL HYDRAULIC GRINDER

HYDRAULIC PUMP UNIT SHOWN IS CONCEALED INSIDE CABINET

The K. O. Lee Company makes available a large selection of fixtures adaptable to the B900 series grinders. Partial list includes: Motor Driven Work Heads, Tap Grinding Fixtures, Tilt Table Attachments for forming and sharpening cemented carbide tools, High Speed Grinding Attachment, Radial Grinding Fixtures, Universal Work Holding Fixtures, Sensitive Work Heads, Diamond Dressers, and Cutter and Hob Grinding Arbors.

HYDRAULIC POWER UNIT

For Table Traverse Available on all

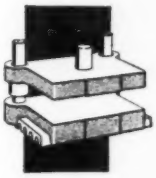
LEE B900 SERIES GRINDERS

Hydraulic Pump Unit Shown Is Concealed In Base Cabinet

CLIP AD TO LETTERHEAD
AND SEND FOR COMPLETE LITERATURE

K. O. LEE COMPANY, ABERDEEN, SO. DAKOTA

CIRCLE INFORM-A-GRAM KEY NO. 24



NOW all SUPERIOR die sets have Superfinish

GUIDE PINS

HIGH LUSTRE MICROFINISH (2-5 Micro Inches)

Results in

1. **Maximum Surface Hardness**
2. **Increased Bearing Surface**
3. **Longer Pin and Bushing Life**
4. **Greatly Reduces Possibility of Scoring**
5. **SMOOoother Action**

The process of Super Finishing removes the soft outer skin (appx. .0002-.0003) caused by the heat induced as a result of grinding.

Super Finish eliminates charging which is common to pins lapped with an abrasive compound.

Super Finishing, long a prerequisite in the Automotive and Aircraft Industry for precision bearing surfaces, is now a standard on Superior guide pins. With Super finished guide pins ideal clearances can be maintained due to a greater bearing surface.

For Fast Local Service Call These Superior Representatives

Kalamazoo, Mich. Fireside 5-7088	Winter Park, Fla. 4-0404	Schenectady, N. Y. Franklin 2-4381
Indianapolis, Ind. Clifford 5-5068	Minneapolis, Minn. FR 1-1321	North Haven, Conn. Cedar 9-1851
Rockford, Ill. 3-3881	Memphis, Tenn. 32-7727	Racine, Wis. Melrose 2-1900
Dayton, Ohio Hemlock 8209	East Orange, N. J. Orange 5-5810	
Chicago, Ill. Randolph 6-6971	Denver, Colo. Enterprise 234	Plants at
St. Louis, Mo. Jeff 5-1220	Agawam, Mass. Republic 9-1132	Milwaukee, Wis. Mitchell 5-9927
Dallas, Texas Riverside 5128	Madison, N. J. Frontier 7-0407	Finleyville, Conn. Sherwood 7-5781

another die set advancement by **SUPERIOR STEEL PRODUCTS CORP.** 2754 S. 19th ST., MILWAUKEE, WIS.

CIRCLE INFORM-A-GRAM KEY NO. 25

Working with foreman Bill Todd (right) of Whitin Machine Works, Whitinsville, Mass., Bay State distributor, Vic Ericson (left) of Johnson deVou, Worcester, Mass., helped cut Whitin's grinding costs thousands of dollars per year.

They made 1 wheel do the work of 12

Centerless grinders at Whitin Machine Works were handling parts ⅛" to 5" diameter in bronze, brass, aluminum, cast iron, Meehanite and various steels. Short runs averaged between 3 and 300 pieces. With a dozen different wheels in use, the opportunities for savings on wheel changes alone are tremendous.

Department foreman Bill Todd wanted to simplify. He was looking for *a single all-purpose wheel that would eliminate all wheel changes due to varying job requirements.*

For a while it looked as though he was asking the impossible. But Bay State distributor Vic Erickson went to work with the sales engineering staff at Westboro and came up with a solution . . . a single wheel that handles the entire range of sizes and metals with only one dressing an hour. Finishes average #16RMS . . . go as fine as #2 with special care.

Whatever your company's abrasive problems may be, you'll find Bay State representatives ready to help and competent to work out practical solutions.

BAY STATE WHEELS of PROGRESS

BAY STATE ABRASIVES

Bay State Abrasive Products Co., Westboro, Mass.
Branch Offices and Warehouses: Bristol, Conn., Chicago, Cleveland, Detroit, Pittsburgh.
Distributors: All principal cities. Bay State Abrasive Products Co. (Canada) Ltd., Brantford, Ontario

CIRCLE INFORM-A-GRAM KEY NO. 26

HERE'S EASY, INEXPENSIVE AUTOMATION

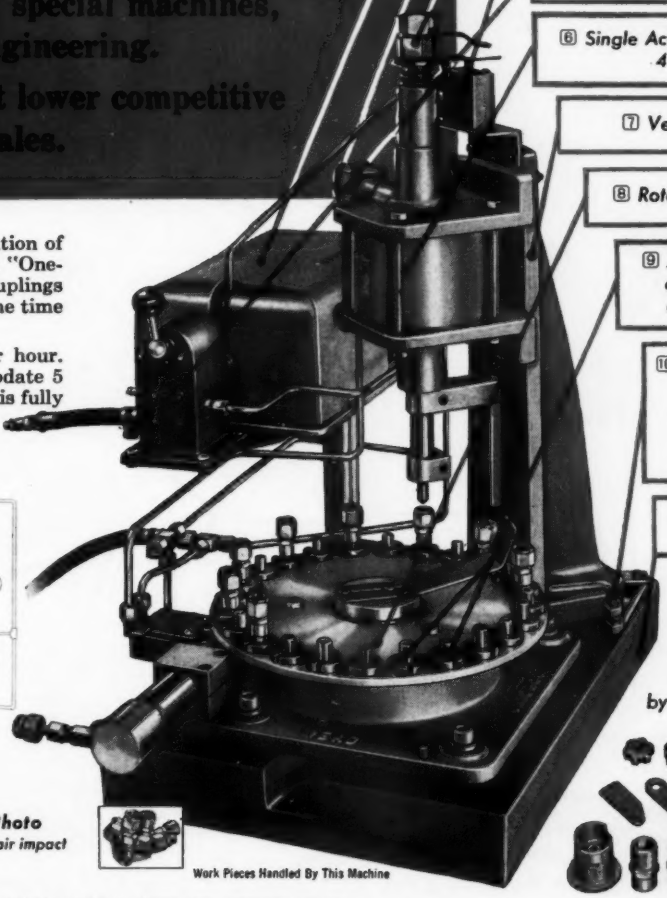
YOU can reduce your cost of making small parts!

Standard Mead units combine easily to make automatic special machines, with little or no engineering.

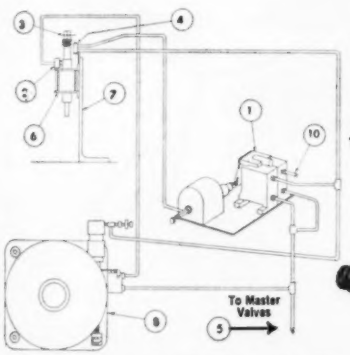
Lower costs permit lower competitive prices, increased sales.

A simple and inexpensive combination of Mead pneumatic devices makes a "One-Man Factory" to assemble brass couplings by flaring neck into nut, at the same time forming a fluid-tight seat.

Output approximately 2500 per hour. Two sets of 12 mandrels accommodate 5 different styles and sizes. Operation is fully automatic except for loading.



1. Model 2 Meadmatic Timer
2. #2 Quick Exhaust Valve to speed up return stroke
3. Adjustable depth stop with spring return
4. Cycle release valve (included with timer) to reverse cycle at end of down stroke
5. 4-B Master Valve starts and stops entire system
6. Single Acting Cylinder, 4" bore
7. Vertical Stand
8. Rotary Work Feeder
9. Alternate mandrels for two sizes of brass couplings
10. Air blast ejection of finished parts, by jet piped from second of two valves in timer
11. Universal Base



Circuit Diagram of Units in This Photo
Combine readily to feed work to drill press, air impact hammer for a wide variety of operations.

Work Pieces Handled By This Machine

Typical Work Pieces Handled *by Mead work feeders*

MEAD SPECIALTIES COMPANY, HA-97, 4114 N. Knox Ave., Chicago 41, Ill.

Memo Coupon

MEAD SPECIALTIES CO.
4114 N. Knox Ave., HA-97, Chicago 41, Illinois

Send free copy of new, colored MEAD INDUSTRIAL AIR POWER CATALOG describing the complete line of famous Mead air-operated devices.

Name_____

Company_____

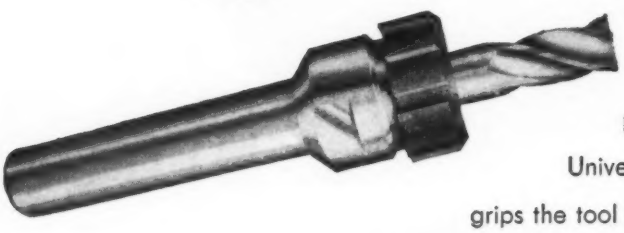
Address_____

City_____ Zone____ State____

CIRCLE INFORM-A-GRAM KEY NO. 27

FOR A REAL GRIP

USE UNIVERSAL COLLET CHUCKS

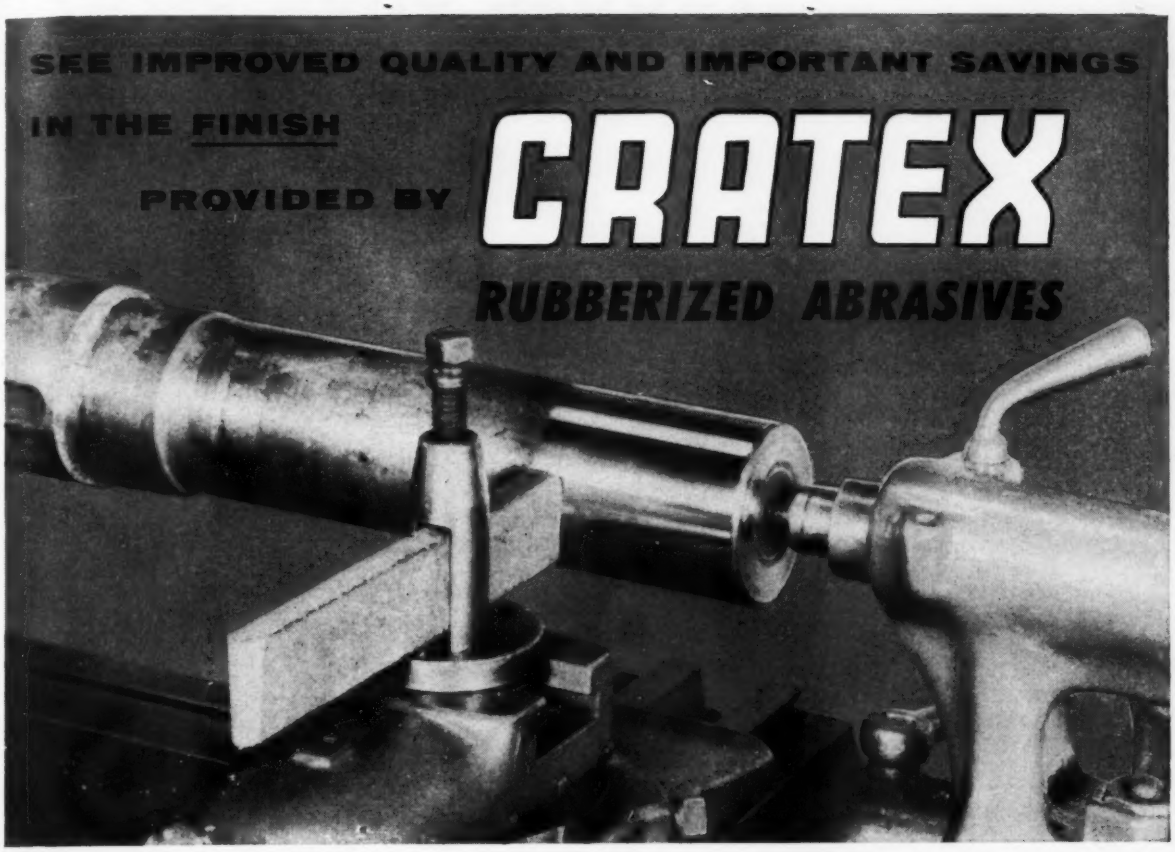


A sure, solid grip on tools is provided by the wrap-around action of Universal chucks because the slotted collet grips the tool on a continuous surface the full length of the collet. Tools can't slip and tool shanks don't get scored. Even tool stubs and broken drills can be used successfully. Sizes range from 1/16" to 1 1/2", with shanks to fit any machine. Simplified design results in low chuck cost to you. Write today for new "complete line" catalog.

UNIVERSAL ENGINEERING CO. Frankenmuth 8, Michigan

197

CIRCLE INFORM-A-GRAM KEY NO. 28



MILK PROCESSING EQUIPMENT

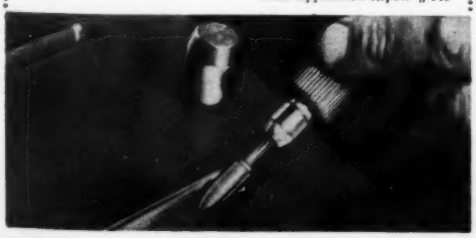
Polishing hard to reach spots on stainless steel with grinding wheels and emery paper proved too slow with poor results. Cratex cones Nos. 1340-C, 1359-C, 1340-M and 1359-M produced a highly polished, scratch-free surface much faster. Easy cleaning and less danger of bacterial contamination resulted.

Field Application Report #121

CAST IRON PLASTIC MOLDS

Final finishing of molds for glass reinforced plastic articles was unsatisfactory for efficient pressure molding and product appearance. Cratex 112-M and 216-M wheels and 1358-M cones produced the required fine finish and greatly reduced or eliminated finishing on molded articles and improved product appearance.

Field Application Report #115



In virtually every metal working operation where a high degree of surface smoothness is required, Cratex Rubberized Abrasives lower costs and improve quality. They are used successfully on hard and soft metals . . . for deburring, smoothing and polishing . . . in tool and die shops . . . on production lines . . . and in the full range of machined and fabricated metal products.

Use Cratex to replace many slow, hand operations, to increase dimensional control, and to eliminate many multi-step operations. Cratex lowers costs, saves time and rejects because it finishes faster, more smoothly, and with minimum danger to tolerances. Order Cratex in Wheels, Points, Blocks, Sticks or Cones—in four grit textures.

TEST CRATEX IN YOUR OWN PLANT
WITH THIS NEW POLISHING KIT
24 ITEMS FOR ONLY $12.50

Wheels, Blocks and Cones in a variety of grit textures, to demonstrate how CRATEX can save you money and improve quality in your own operations.

☐ Here is our P. O. for the CRATEX Polishing Kit, at $12.50 (Will be sent thru industrial distributor in your area)

☐ Please send complete CRATEX catalog (Free)

Name_____

Company_____

Title_____

Street_____

City_____ Zone____ State_____

CRATEX MANUFACTURING CO.
81 Natoma St., San Francisco 5, Calif.

CIRCLE INFORM-A-GRAM KEY NO. 29

Northwestern TOGGLE-SHOE CLAMPS

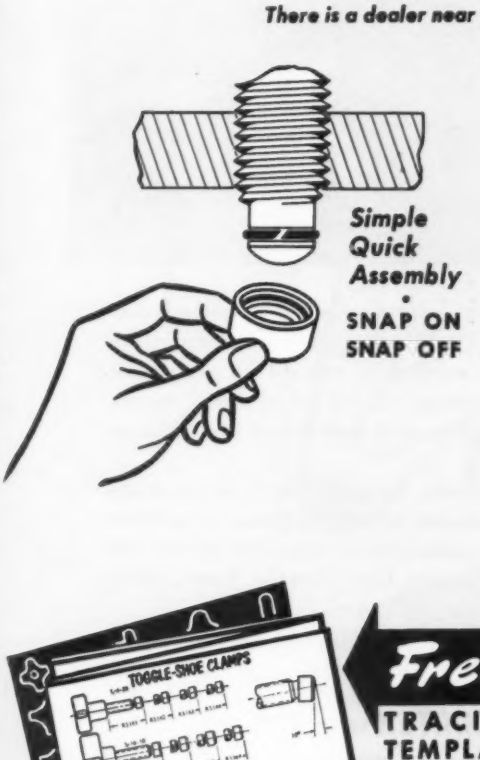
THREE NEW SOCKET TYPES! KNURLED SHAFT • KNURLED HEAD • HAND KN

ALL TYPES ARE INTERCHANGEABLE WITH *"SNAP ON-SNAP OFF"* ROUND OR V-PA

PATENT APPLIED FOR

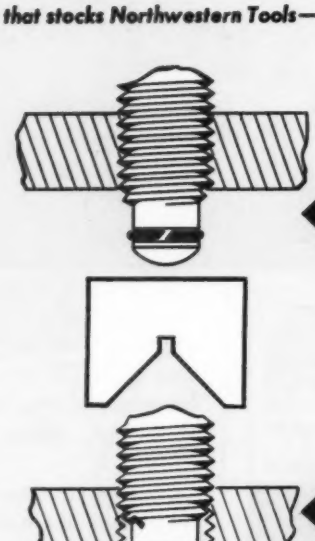
SIZES — ¼-20 to ⅝-11 **LENGTHS — 1" up to 5¼"**

There is a dealer near you that stocks Northwestern Tools—Write for information.



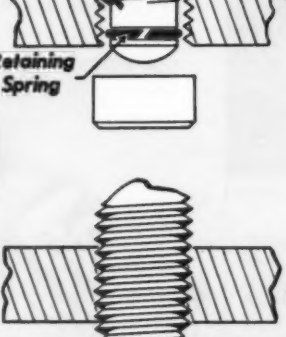
Simple Quick Assembly

SNAP ON SNAP OFF



10° ADJUSTMENT in all directions

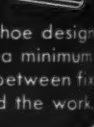
Retaining spring ho shoe in place yet lows a full 10° adj ment in all directio



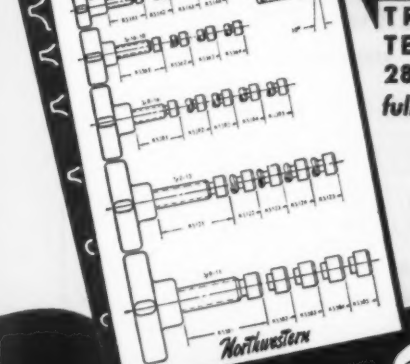
Retaining Spring

NO INTERFERENCE

Shoe only 1/16 larger than bolt



Short shoe design quires a minimum tance between fix and the work.

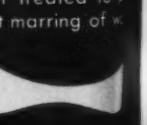


Free

TRACING TEMPLATE 286 ITEMS

full Scale • •

HEAT TREATED for max. toughness



Screw is heat trea for long life—sho heat treated to vent marring of w

CIRCLE INFORM-A-GRAM KEY NO. 30

116 HOLLIER AVE. ***Northwestern*** **DAYTON 3, O**

. . . Minimizing from page 17

was the most important part of the job. Let's imagine too that we had a technique capable of predicting how each of the 10 candidates would function in each part of the job and that we discovered they would all do about equally well in this respect. Obviously then, with respect to the most important part of the job, it would make very little difference which of the applicants was selected. But suppose further that maintaining inventories was considered to be half as important as settling grievances and that the applicants varied widely in their ability to perform in this function.

Now, let's suppose that we narrowed the field down to 2 applicants and Mr. A was the best individual on the most important function and Mr. B the poorest (but without too much difference between the best and the poorest on this function). With respect to maintaining inventories, let's assume that the opposite relationship existed — that Mr. B was best and Mr. A was worst. (And let's recall that although this function was only half as important as the first one, variability on it was much greater.) Logic would normally dictate that we pick the man with the best predicted performance on the most important job function.

But would this be the wisest choice?

Obviously not, from the point of view of over-all job performance. Since the variability on the important job factor was slight, it would make very little difference as to who was selected. But, on the less important trait, variability was extensive and so would be performance on the job. Therefore, the wiser choice would be to afford greater weight to the less rather than the more important job function.

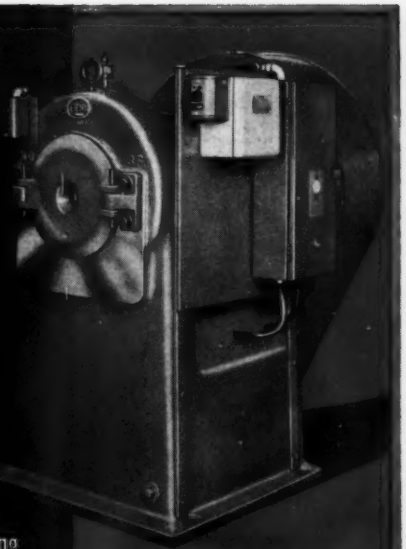
In actual practice the relationships are neither as simple nor as clear-cut as in the hypothetical example that we have drawn; fortunately where it is possible to collect data and perform the necessary research, statistical techniques exist by means of which the appropriate weights can be assigned to each of the predictors.

We sometimes overlook the fact that there are some pretty involved technical aspects that determine the success of our personnel decisions. It certainly applies here. To make certain in foreman selections that the important parts of the job are given proper weight, two things are worth keeping in mind:

(1) Decide what is important in the job, and then look for the most practical way to predict it. Do not use what "happens to be around" just because it is convenient.

. . . *Continued on page 36*

What is your swaging I.Q.?



Are you aware of the new techniques and equipment that are making rotary swaging increasingly important as a basic precision production process? Test your knowledge of modern rotary swaging with this TRUE or FALSE quiz.

SWAGING is economical—no chips, no scrap . . .

SWAGING produces work accurate within ± .001" . . .

SWAGING improves physical characteristics . . .

SWAGING can produce inside contours . . .

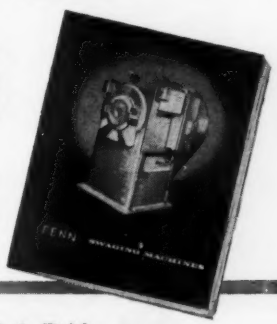
SWAGING can be automatic or semi-automatic and does not require skilled labor for operation . . .

FENN is one of the largest manufacturers of a complete size range of swaging equipment . . .

FENN swaging equipment swages tubing up to 6¼" diameter and solid bar stock from pinpoint to 3¾" diameter . . .

If you answered TRUE to all the questions, your knowledge is excellent. If not, you should have more information on modern rotary swaging.

In either case, it will pay you to get a copy of the new Fenn Swaging Catalog No. SM56. Write today!



FENN ROTARY *Swaging Machines*

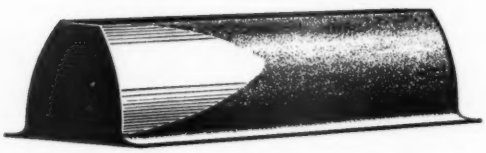
FENN MANUFACTURING CO.
204 Fenn Road NEWINGTON, CONN.
CIRCLE INFORM-A-GRAM KEY NO. 31

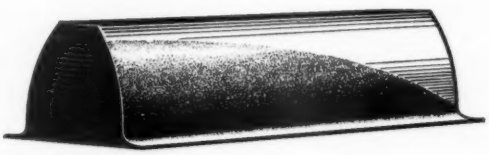
Hard Gear Honing

GIVES YOU BETTER GEARS AT LESS COST

QUICK GEAR INSPECTION

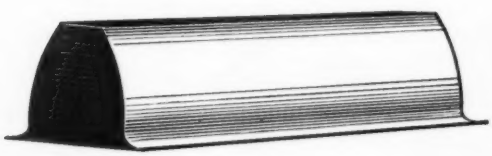
One quick pass with a Red Ring honing tool cleans up the teeth or immediately reveals heat-treat distortions, thus indicating corrective adjustments in the gear forming processes.





CORRECTION OF HEAT-TREAT DISTORTIONS

Minor distortions in tooth profile, helix, index and runout are corrected in from 15 to 60 seconds of honing time.



IN ADDITION

Gear honing provides:

- The Lowest Cost Remedy for Nicks and "Hickies"
- Improved Tooth Surface Smoothness
- Overall Sound Improvement

For Quality Gear Production, write for Bulletin H57-2 which gives the full story on Red Ring Hard Gear Honing.

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING
AND ELLIPTOID TOOTH FORM

NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

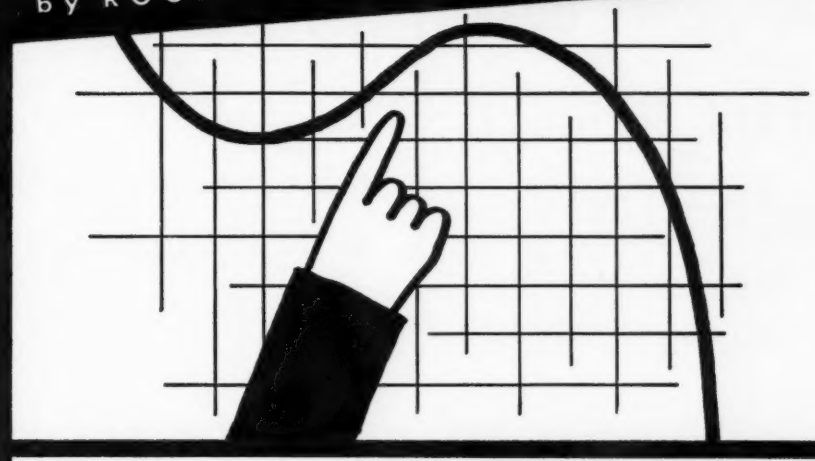
WORLD'S LARGEST PRODUCER OF GEAR SHAVING MACHINERY

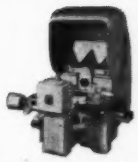
7875

CIRCLE INFORM-A-GRAM KEY NO. 32

DROODLES

by ROGER PRICE





Bench Model BC-14D

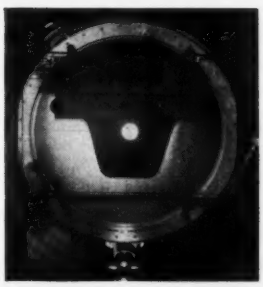
Floor Model FC-30

Floor Model FC-14

"SALES MANAGER APPROACHING DANGEROUS CURVE"

Although this starkly dramatic Droodle even has an alternate title ("Man showing veterinarian the location of his horse's blister") I must confess it really isn't a Droodle, at all. It's part of my personal coat of arms, designed by me. The major device is a vulture rampant on a field of corn. The quadrant sinister shows a mailed fist smashing a sour tomato couchant; the quadrant dexter is a montage of brass knuckles and loaded dice on a field of seaweed. The frayed ribbon above the shield proudly proclaims "Semper Fiasco", the blood-stirring battle cry that has been my family's motto since the first Roger stormed the heights at Lasagna. As the saying goes, I may be short of breath, but I'm long on tradition.

There's tradition a'plenty behind Jones & Lamson Optical Comparators. Intensive research, plus the skill and experience gained through more than a century of precision manufacturing, make the J&L Optical Comparator the finest instrument of its kind. Throughout industry, it's helping companies of all sizes, from the largest plants to the smallest job shops, improve production, maintain high quality and cut costs. This precision-built instrument inspects and measures all sorts of parts, even intricate ones, speedily and accurately (to .0001″). It is remarkably flexible and versatile, and can easily perform inspections that are impossible by any other method. J&L Comparators are available in a range of eleven models, both bench and floor types. For complete information, send this coupon *today*.



JONES & LAMSON COMPARATORS *On the Job...*

at Omaton Division of the Burndy Corporation
Norwalk, Connecticut

Savings of up to 20 minutes per indenting die were made by inspecting the dies — used for crimping electrical connectors — on the J&L Comparator, at 10 magnifications.

A single tolerance outline chart indicates contour, over-all height, and major and minor widths of the "nose".

The operator merely rotates the die — 90° on a common axis — and compares the magnified shadow image with the tolerance lines indicated on the chart.

"The originator of machine tool standards in optical inspection"

JONES & LAMSON

JONES & LAMSON MACHINE COMPANY, Dept. 710, 519 Clinton Street, Springfield, Vt., U.S.A.

Please send me Comparator Catalog 402-C, which describes the complete line of J&L Optical Comparators.

name _____ title _____ street _____

company _____ city _____ zone _____ state _____

EVERY HEAVY DUTY SURFACE GRINDER SHOULD HAVE:

- *Open-side Accessibility*
- *100% Hydraulic Table Drive*
- *Built-in Spindle Motor*
- *Centralized Controls*
- *Low Pressure Hydraulic System*
- *One-Shot Lubrication System*
- *Adequate Safety Devices*

BUT THEY DON'T—

So GET A HILL with ALL the above features *plus* many other design improvements which insure rapid stock removal and accurate grinding of flat surfaces within the periphery of the grinding wheel. HILL Vertical Spindle grinders are built in table widths of 18", 24" and 30" with table lengths from 5 to 20 ft.

18" x 24" x 204" HILL Vertical Spindle Open-Side Hydraulic Surface Grinder. (Also built in Horizontal spindle design)

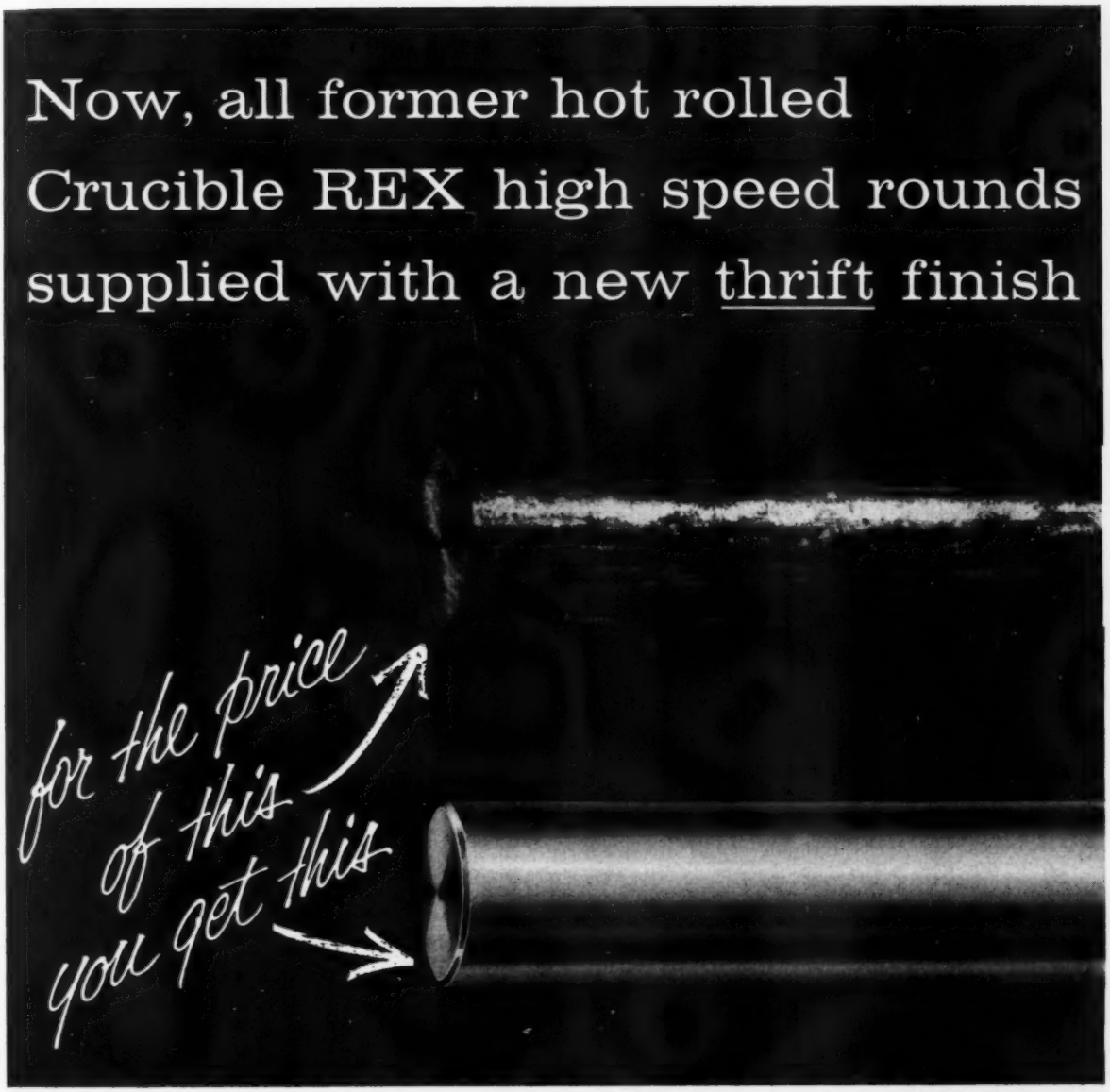
THE HILL ACME COMPANY

12031 WEST 65th STREET • • • CLEVELAND 2, OHIO

"HILL" GRINDING & POLISHING MACHINES • HYDRAULIC SURFACE GRINDERS • ALSO MANUFACTURERS OF "ACME" FORGING • THREADING TAPPING MACHINES • "CANTON" ALLIGATOR SHEARS • BILLET SHEARS • "CLEVELAND" KNIVES • SHEAR BLADES

CIRCLE INFORM-A-GRAM KEY NO. 34

Now, all former hot rolled Crucible REX high speed rounds supplied with a new thrift finish



Here's a revolutionary, new Crucible policy designed to provide an improved product—save time and processing costs. Now, Crucible furnishes all REX® high speed rounds from ⅝" up with a machined surface, close to size and free from decarburization. All bars from ¼" to ⅝" round are supplied cold finished.

This new *thrift* finish means important savings to you – whether you've been paying extra for decarburization and stock removal, or grinding or rough turning rounds in your own shop. Of course, where extremely close tolerances are demanded, precise centerless grinding is still available at a small extra.

It's another Crucible "first" that offers you substantially more for your high speed steel dollar. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Canadian Distributor—Railway & Power Engineering Corp., Ltd.

CIRCLE INFORM-A-GRAM KEY NO. 35

PRECISION PRODUCTION PROBLEMS ?

Here's help from Bausch & Lomb in TOOL DESIGN INSPECTION FABRICATION MEASURING TESTING

NEW! ALIGNMENT INTERFEROMETER

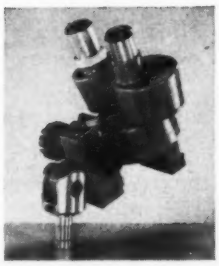
Accurately measures small changes in angle over a range of 30 seconds of arc (±15 seconds). Easy direct scale readings to 0.2 seconds (0.000006″).

BENCH COMPARATOR

Exclusive understage illumination—no complex set-ups, no holding fixtures for most work. Magnified silhouettes show errors instantly. Reads to 0.0001″ with optional micrometer stage.

STEREO-MICROSCOPES

Magnified 3-D views of tiny parts. Dustproof, shockproof, can be mounted right in machine or fixture. Speeds assembly, inspection. Most complete line, widest field of view.



CONTOUR MEASURING PROJECTOR

Shows magnified silhouettes or surface views. Simple operation, highest precision measurements: to 0.0001″, linear; to 1 minute of arc, angular.

OPTICAL AIDS CATALOG

Time-and-money-saving data on Surface Comparators, Industrial Magnifiers, Macroscopes, Microscope Bodies, Micrometer Discs, Wide Field Tubes, Brinell Microscopes, Shop Microscopes.

NEW TOOLMAKER'S MEASURING MICROSCOPE

Quickly measures opaque or transparent objects of any contour. Linear, accurate to 0.0001″; angular, to 1 minute of arc.

MAIL COUPON TODAY FOR VALUABLE DATA

BAUSCH & LOMB OPTICAL CO.
79821 St. Paul St., Rochester 2, N. Y.
Please send literature on optical production aids checked below:

☐ Alignment Interferometer ☐ Bench Comparator ☐ Contour Measuring Projector ☐ Toolmaker's Microscope ☐ Stereomicroscopes ☐ Optical Aids Catalog

NAME .....
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COMPANY .....
ADDRESS .....
CITY ..... ZONE ..... STATE .....

BAUSCH & LOMB
SINCE 1853

CIRCLE INFORM-A-GRAM KEY NO. 36

. . . Minimizing from page 31

(2) Remember that variability must be considered. Even if a given skill is vital to success, if every candidate possesses it to an adequate degree, it is not important to foreman selection.

Scale Unit Bias

In thinking about measurements in general, most of us are accustomed to dealing with units of physical length — the inch, the foot, the yard, the mile, etc. We become so accustomed to these units that we tend to forget that they are themselves quite arbitrary but highly standardized. The inch, legend has it, arose as a standardization of the end joint of a man's thumb; and the foot, as its name implies from the length of an adult's foot. Before the days of standardization the long-jointed and big-footed man had a decided advantage over his stubbier business colleague. In psychological measurement, we do not have the rigid standardization that has been achieved in the last century with respect to linear measures. We do not even have the fairly constant reference points like the end joint of the thumb. Measuring with psychological instruments, whether they be tests or rating scales or what have you, is somewhat analogous to using a soft elastic ruler for linear measures — the "inches" are of different lengths at different places on the scale.

The problem of psychological scaling is a technical one for which no wholly satisfactory solution has yet been reached. We have some general principles as well as a number of specific guides for specific instruments. We know for example, that generally speaking raw score units in the vicinity of the average of a distribution on a psychological attribute are "smaller" than are similar units at the high or low end of the scale. We know too that things can get pretty fouled up when we innocently try to add such things as percentage scores, or to average ranks, or to combine the raw scores of psychological tests or other instruments. The subtleties of combining scores from various sources if not properly handled, can introduce a serious bias into the evaluation process and in part at least to mitigate the effectiveness of foreman selection.

PROTECT YOUR FUTURE
BUY US SAVINGS BONDS TODAY!

Another cost-conscious manufacturer finds that—

When the going gets tough ...put it on a Warner & Swasey

A modern Warner & Swasey Turret Lathe's cost-cutting combination of power, rigidity and accuracy has increased production of this piece 200% for R. H. Little Co. of Canton, Ohio.

TOUGH STEEL diesel-electric locomotive parts, designed by The Timken Roller Bearing Company, are run in 500-piece lots at the rate of 12 to 15 daily on R. H. Little's new Warner & Swasey 4-A Saddle Type Turret Lathe.

In addition to heavy stock removal, severely-interrupted cuts put a terrific strain on both tooling and machine. But their Warner & Swasey's power and rigidity easily handle this job.

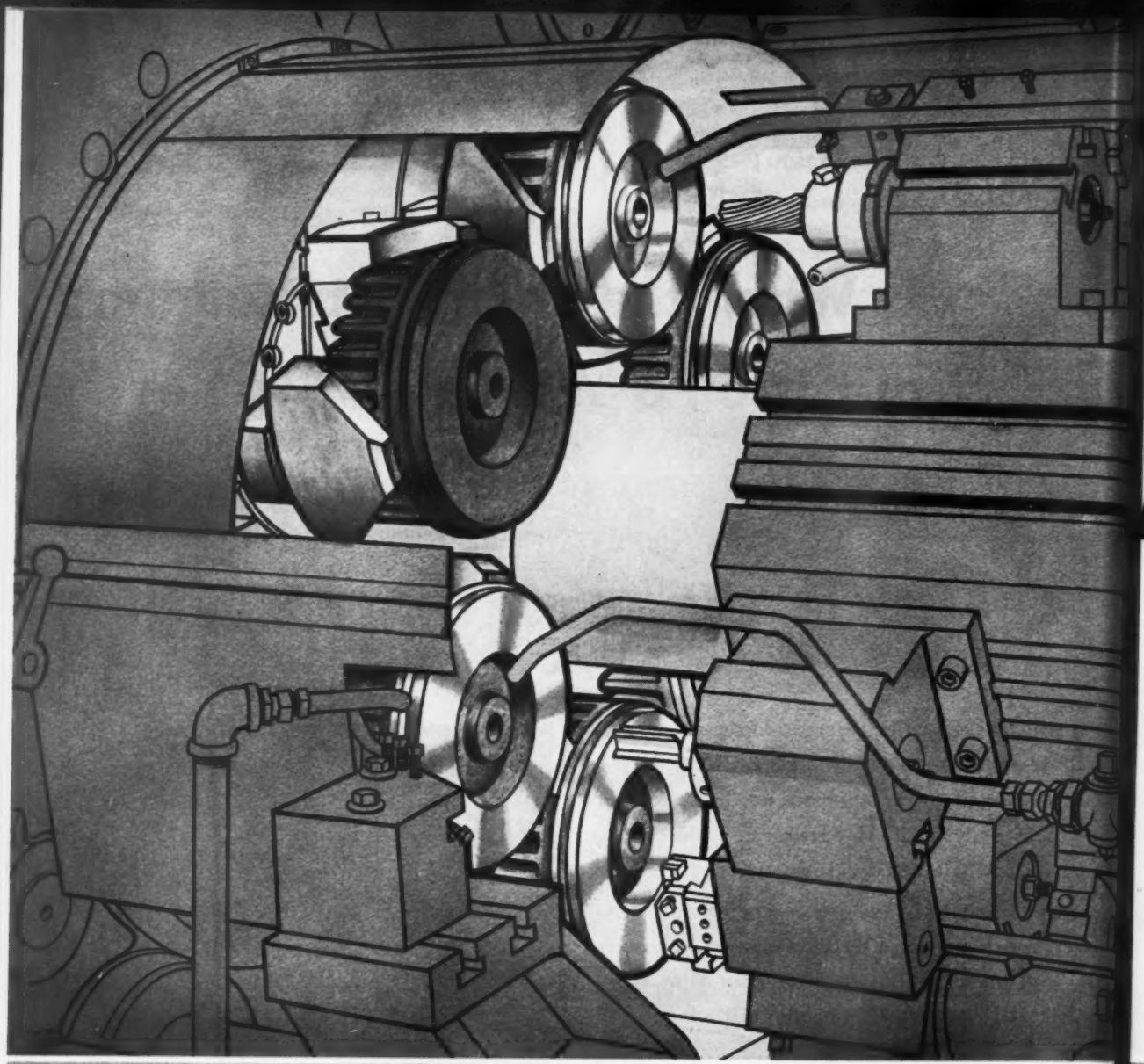
This same casting was previously machined at the rate of only 5 a day when run on a 20-year-old lathe. Production was held down due to the machine's lack of horsepower and rigidity. This caused excessive downtime for tool changing and required constant operator attention to maintain required accuracy.

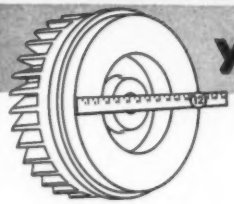
This is but another example of how today's alert metalworking management is profiting through the realization that... **When the going gets tough... put it on a Warner & Swasey.**

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS ...WITH A WARNER & SWASEY

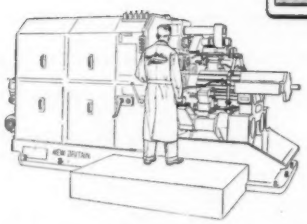
CIRCLE INFORM-A-GRAM KEY NO. 37





yes! you can put it on a New Britain

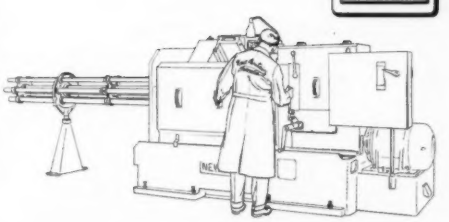
Now the larger pieces which formerly necessitated slower methods because of their size can be turned out at lower cost. You can, for the first time, apply New Britain standards of productivity to larger work with the *new* New Britain four-, six- and eight-spindle chuckers . . . new, larger chucking capacities (10 inches on 8-spindle, 12 inches on 6-spindle, and 15 inches on 4-spindle models), with spindle speeds, power and ruggedness to match, and all the exclusive New Britain advantages. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



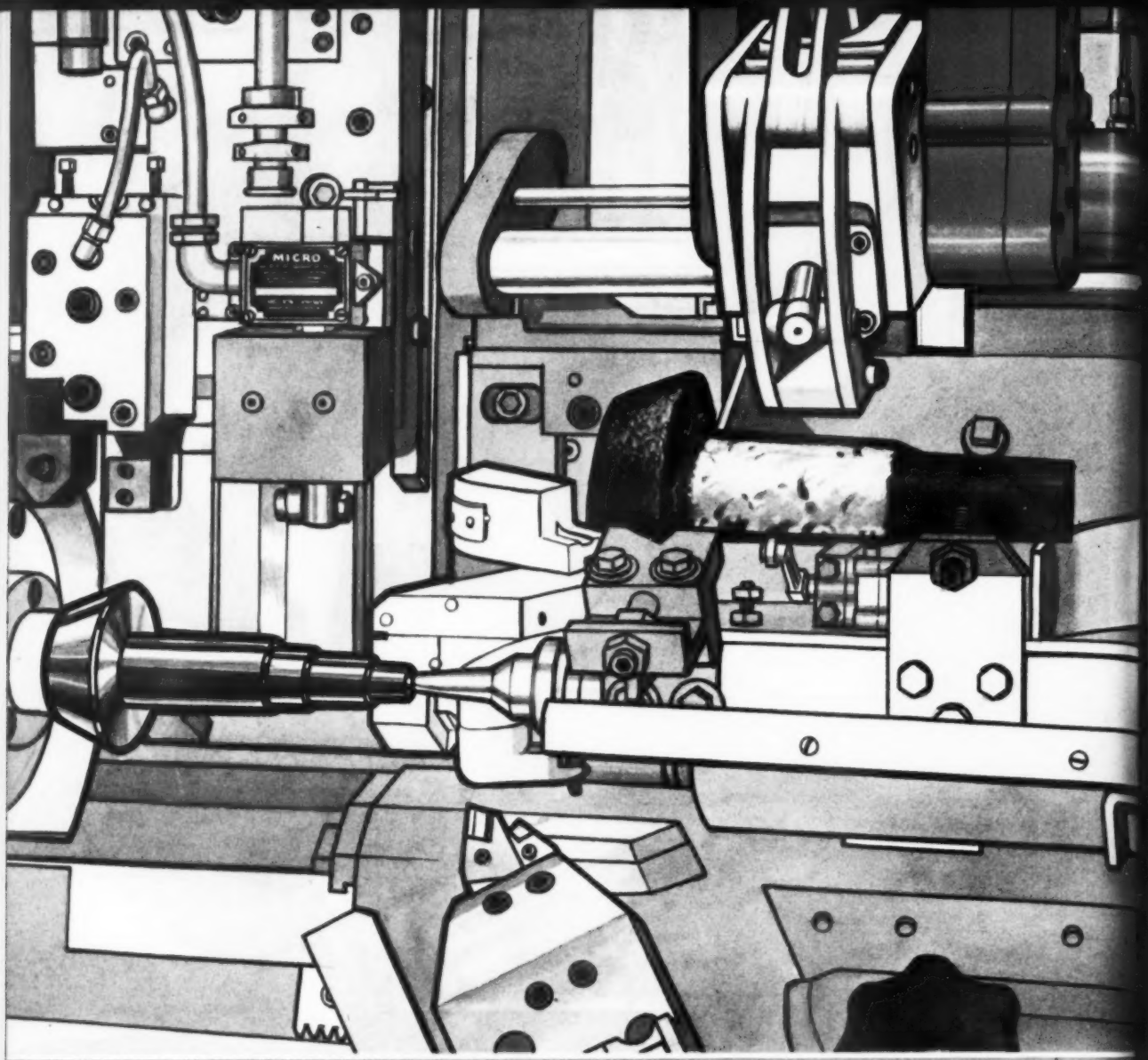
Automatic Chucking Machine

six spindles — six cross slides

Here you see the possibilities for new flexibility of bar machine set-ups with *a cross slide in every position.* Six independent cross slides. More operations on one bar machine. Six independent radial cross slides for forming, roll threading, shaving, skiving, angular facing, knurling, hobbing and undercutting with simpler tools and attachments, through the use of cross slides. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



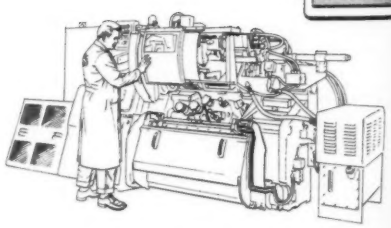
Automatic Bar Machine



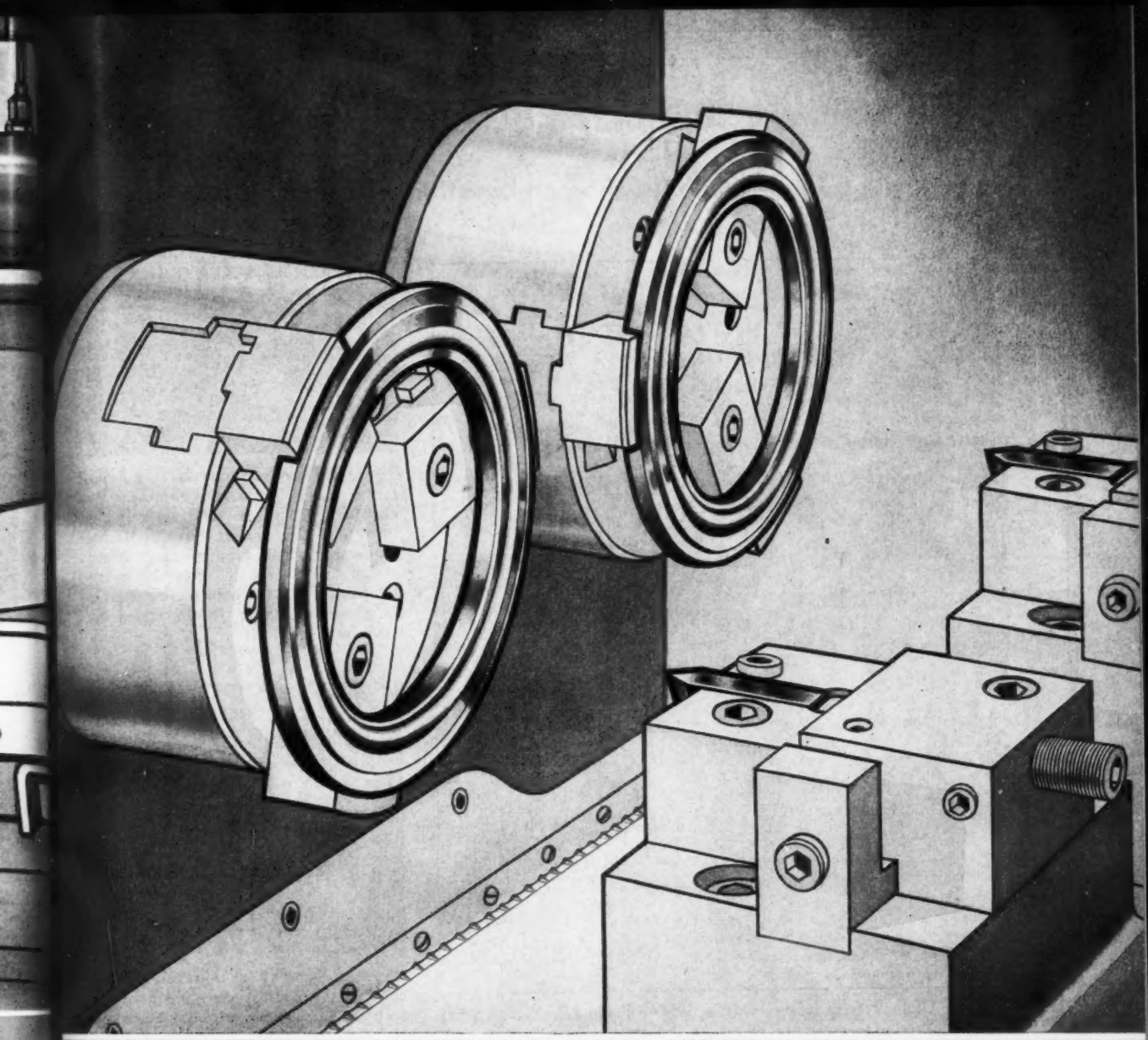
no hands — no headaches

Automatic loading of forgings, bar slugs and bar stock is a basic optional design feature of New Britain **+GF+** Copying Lathes. It saves labor and makes a substantial reduction in production time per piece.

Positive, accurate loading, single point tooling and template control mean fewer headaches and larger profits on your lathe work. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



New Britain **+GF+** Copying Lathe



fewer tools to buy — set — adjust — replace

Cam controlled New Britain Precision Boring Machines utilize a single tool to bring several surfaces to precision tolerances — instead of a tool for every surface. Think of New Britains when you're looking for a fresh approach to lower cost per piece. Whether the part is simple or complex, you'll use fewer tools on a New Britain. Automatic gauging and tool resetting available if required. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

Precision Boring Machine

CIRCLE INFORM-A-GRAM KEY NO. 41

Up to 40% higher tightening torques keep a

—and only the combination of an UNBRAKO screw

RECOMMENDED SOCKET SET SCREW TIGHTENING TORQUES
(Inch-Pounds)

SCREW SIZE	UNBRAKO	SET SCREW B	SET SCREW C	MINIMUM DIFFERENTIAL %
#4	5	3.9	3.5	28
#5	9	7.8	7.4	15
#6	9	7.8	7.4	15
#8	20	14.7	14.5	36
#10	33	26.5	25	25
1/4	87	62	60	40
5/16	165	122	125	32
3/8	290	198	225	29
7/16	430	309	350	23
1/2	620	460	500	24
5/8	1225	1106	1060	11
3/4	2125	1540	1800	18
7/8	5000	3660	4600	9
1	7000	5025	6500	8

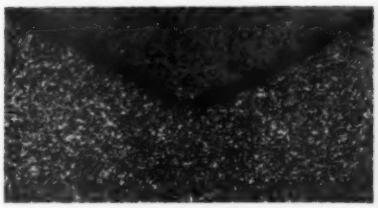
The High-Torque UNBRAKO socket set screw is made to withstand the highest tightening torques ever used to seat a set screw—up to 40% higher than an ordinary set screw. But to take full advantage of this UNBRAKO feature you must have a key that can apply the force required to seat it without damaging the screw or snapping the key. The High-Titan UNBRAKO hex key is designed specifically to set a High-Torque UNBRAKO so that you can be assured of full *high-torque* performance every time.

Here's why a High-Torque UNBRAKO can be seated tighter—and stay put

UNBRAKO SET SCREW

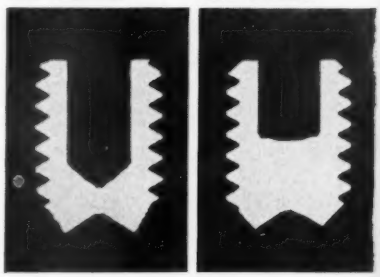
It has fully formed threads that make the whole screw stronger. The metal is compressed into the closely knit grain structure that you see in this illustration. The grain flow follows the contour of the threads. There are no straight lines along which shear can occur. The UNBRAKO retains its flow lines even when ground down to .010 in. below root diameter. Screws with cut or ground threads lose thread form at root diameter.

UNBRAKO SET SCREW



The High-Torque UNBRAKO has a radius in the socket corners. This eliminates the sharp corners where cracks start. It also distributes the stresses developed when tightening torques are applied. Ordinary socket screws have sharp corners which often crack when tightened even at lower torques than those recommended for UNBRAKO.

UNBRAKO SET SCREW **ORDINARY SET SCREW**



The High-Torque UNBRAKO has a deeper socket, which gives you more purchase with the wrench. Since more wrench can be put into the UNBRAKO socket, you can set the screw much tighter. And you won't ream the socket or round the corners of the wrench.

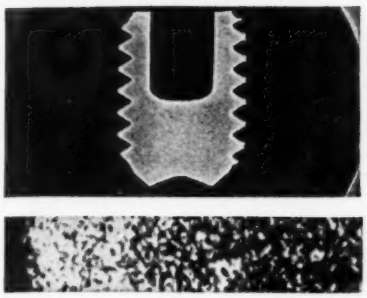
UNBRAKO SET SCREW

The High-Torque UNBRAKO is properly heat treated, kept clean. Its grain structure is uniform. It is free of decarburization. There's no danger of stripping the threads or shearing the point when tightening

High-Torque UNBRAKO socket set screw tight

and key assures full *high-torque* performance

ORDINARY SET SCREW



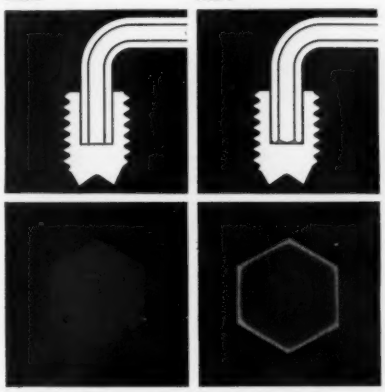
torques are applied. The ordinary screw is suffering from an overdose of decarburization; socket walls, threads and point are full of the telltale white spots that identify it.

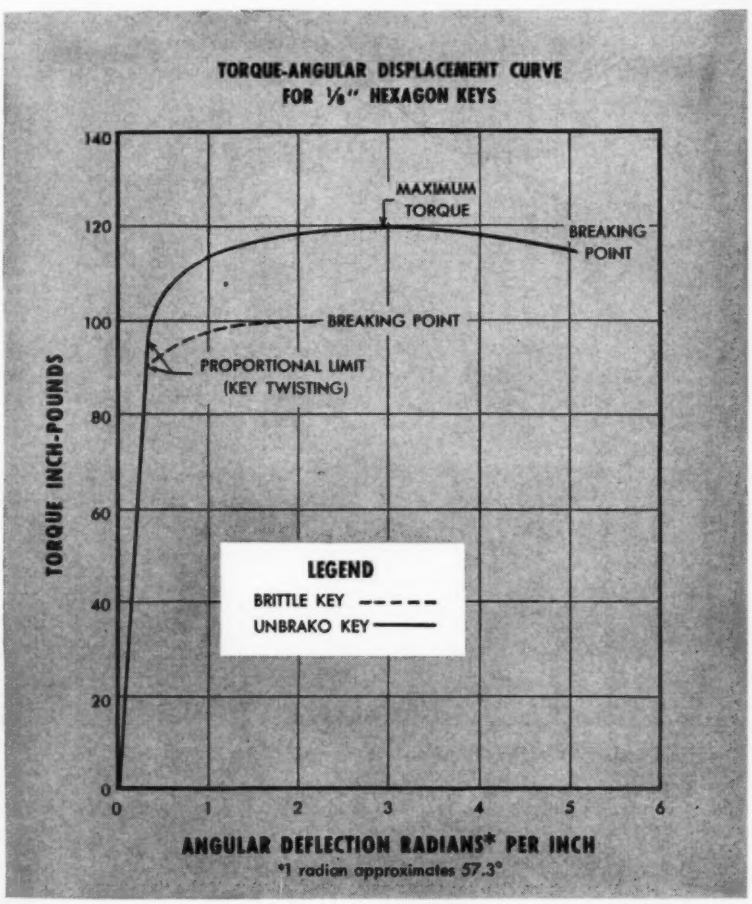
And here's why an UNBRAKO High-Titan hex key can be used to apply far more tightening torque to a High-Torque UNBRAKO socket set screw than is needed without damaging either the screw or the key.

The High-Titan UNBRAKO is not an ordinary hex key. It is a precision internal wrenching tool with high ductility, specially designed to assure full high-torque performance. It is made of special alloy steel bar stock, inspected magnetically and chemically to make sure that the material is flawless and of the specified properties. Its sides are flat and parallel. The corners, which exert torque on the inner walls of the socket, are sharp and tough. The bend is strong.

The High-Titan UNBRAKO is accurately sized across the flats and across the corners to insure snug fit and full wall contact. It won't ream or wear an UNBRAKO socket. The square cut end engages the full depth of the socket for greater tightening power. It gives you up to 25% more wrench engagement than a key with a chamfered end.

UNBRAKO KEY **CHAMFERED END KEY**





The High-Titan UNBRAKO hex key is heat treated in modern atmosphere-controlled furnaces. The surface is casehardened without decarburization. The extra hard surface gives the key longer life. And it retains its dimensional accuracy, is tougher and more ductile than ordinary keys. This torque-angular displacement curve for ⅛ in. hexagon keys distinguishes a High-Titan UNBRAKO from an ordinary key. The High-Titan UNBRAKO has a higher yield point and a higher breaking point—you can exert a much higher torque with it without snapping the key.

Be sure you get the full high-torque performance offered only by the combination of a High-Torque UNBRAKO socket set screw and a High-Titan UNBRAKO hex key. Both products are stocked by authorized industrial distributors. Ask the one nearest you for complete information. Or write STANDARD PRESSED STEEL CO., Jenkintown 36, Pa.

We also manufacture precision titanium fasteners. Write for free booklet.

Unbrako Socket Screw Division SPS **Jenkintown, Pennsylvania**

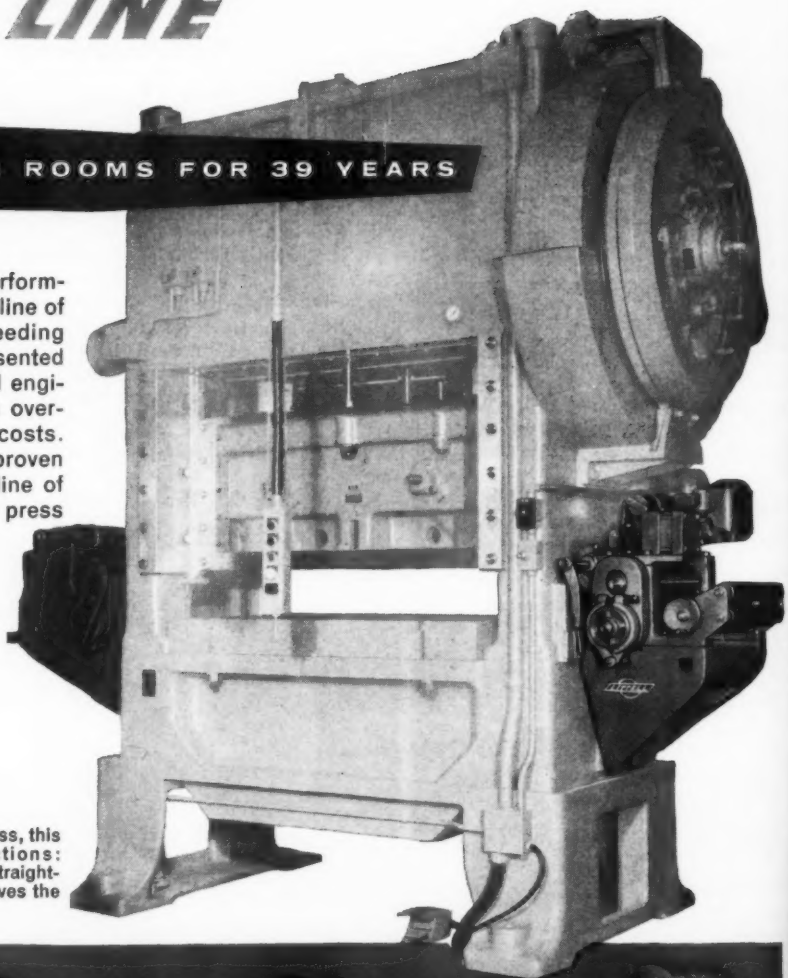
Standard Pressed Steel Co. • The Cleveland Cap Screw Co. • Cooper Precision Products • Standco Canada, Ltd. • Unbrako Socket Screw Co., Ltd.

CIRCLE INFORM-A-GRAM KEY NO. 43

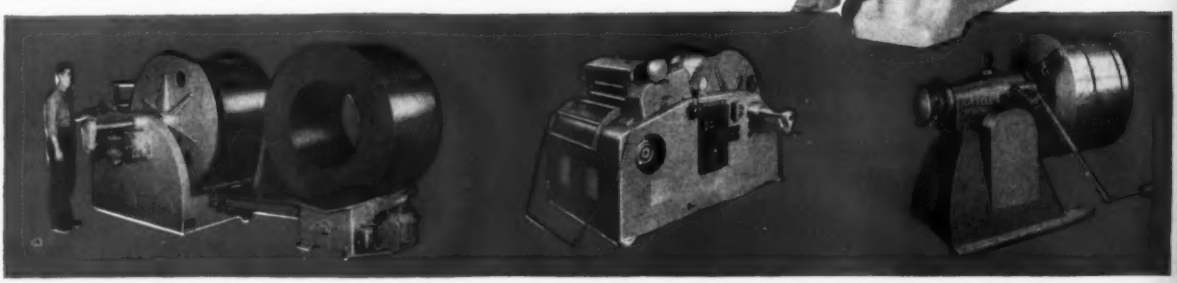
THE LITTELL LINE

PROVED IN PRESS ROOMS FOR 39 YEARS

39 years of proved, dependable performance are behind the complete Littell line of coil handling, straightening and feeding equipment. Since coil stock first presented a curvature removal problem, Littell engineers have helped press operators overcome it, to speed output and cut costs. This big edge in experience and proven quality makes the complete Littell line of today the preferred line among both press builders and press users.



LITTELL DOUBLE RACK AND PINION ROLL FEED, No. 5-24½
Mounted, as shown, on a modern punch press, this typical Littell Feed performs five functions: straightens stock (when equipped with straightener); feeds to the die; oils the stock; removes the scrap; cuts up scrap.



COIL CRADLE
Variable Speed Drive plus electric brake and clutch supply precise length of stock required at exactly the desired speed. Feed Range, 25″ to 100″ per minute. Holds two 10,000 lb. coils, one in reserve. Max. coil width, 36″, O.D., 58″.

STRAIGHTENER-COIL CRADLE
5-roll straightener flanked by powered pinch rolls. 18″, 24″, 30″, 36″ and 42″ roll widths. Variable Speed Transmission feeds 12′ to 72′ per minute. Reversible. Cradle takes 8,000 lb. coil, 48″ max. O.D.

REEL for 5-ton Coils
This motor-driven automatic centering reel with standard arm control handles coils up to 10,000 lbs., 36″ wide and 48″ O.D.

F. J. LITTELL MACHINE CO.
Speed with Safety

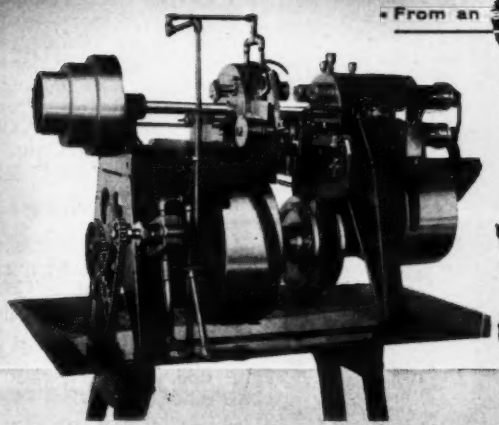
ROLL FEEDS•REELS•STRAIGHTENING AND FEEDING MACHINES•COIL CRADLES•SHEETING LINES
District Offices: Detroit, Cleveland
4197 Ravenswood Ave. Chicago 13, Ill.

CATALOG 56 sent on request gives full details. Write for it.

CIRCLE INFORM-A-GRAM KEY NO. 44

Thanks, Mr. Keebler...

You have said it better than we could!



First successful multiple-spindle automatic—the granddaddy of *all* of today's "multiples"—developed and built by National Acme in 1893.

• History has recorded the machine tool development about which Mr. Keebler writes as the direct prototype of present day Acme-Gridley Multiple Spindles—in fact, it's the granddaddy of *all* of today's "multiples".

• Since the inception and development in 1893 of the first successful Four Spindle Automatic Screw Machine, National Acme has extended the inherent circumferential automation principle of its basic design to six and eight spindle machines. These machines have set the pace with which to meet, head-on, industry's need for greater and less costly production.

• Knowing that the future will make ever greater demands on circumferential automation, National Acme will continue to expand applications for Multiple Spindle Automatics. Who knows?, some day the line may include not only 4, 6 and 8 spindles, but 12 and 16 spindle machines as well.

ing much
this tubing annually that the price

• From an editorial in April, 1957 **AUTOMATION**

by JAMES C. KEEBLER, Associate Editor

Those who think of automation only in terms of production techniques developed since Harder first uttered the magic word *Automation* are thumbing right past a few useful rules. If we aren't careful these newly trained manufacturing engineers will be overlooking a few tricks that have been in the trade since Hector was . . .

Overpublicizing the new developments might overshadow the fact that the methods developed long ago fit the pattern of present-day automation techniques and therefore should not be overlooked in evaluating possible production processes.

A case in point is the automatic screw machine used on these bearing rings. This machine development was placed on the market in the 1890's and incorporated such sound basic automatic machine thinking that it remains primarily the same in principle in its 1957 model.

On these machines are performed in succession and without manual attention virtually all of the circular machining operations required on ball bearing rings. This is automation. Just because the technique is not new is no reason why it should not be given its just place in the galaxy of automation studies.

more
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National Acme

THE NATIONAL ACME COMPANY, 170 E. 131ST ST., CLEVELAND 8, OHIO • Sales Offices: Newark 2, N. J., Chicago 6, Ill., Detroit 27, Mich.

NEW! BAUSCH & LOMB WIDE FIELD MACROSCOPES 10X to 40X

Handy 'scopes spot-check production, speed small parts work

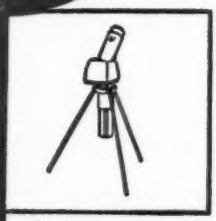
- Actual size as shown here ... compact, handy
- Shows natural right-side-up views... easier for inexperienced users... a big help in precision assembly!

Just grab this dependable inspection aid for on-the-spot checks of work and materials in any phase of production. Available with folding tripod or sturdy microscope stand, for detailed study and for small-parts assembly. You can even build it right into production machinery!

Upright images are sharp and detailed to the very edge of the extremely wide field of view. Long working distance makes it easy to manipulate specimens ... gives operators plenty of room for precision assembly and repairs. (Also available as straight tube for applications where upright image is not required.)

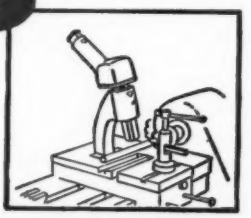
FREE DATA BULLETIN!
ON-THE-JOB DEMONSTRATION!

Find out how this inexpensive production tool can lower your manufacturing costs. WRITE, WIRE or PHONE today for free demonstrations and Data Bulletin D1052. Bausch & Lomb Optical Co., 77321 St. Paul St., Rochester 2, N. Y. (Phone: LOcust 3000).



Use it in tripod...

in microscope stand...



...or even built into machinery!

BAUSCH & LOMB
SINCE 1853

AMERICA'S ONLY COMPLETE OPTICAL SOURCE ... FROM GLASS TO FINISHED PRODUCT

CIRCLE INFORM-A-GRAM KEY NO. 46

FILMS TO SEE

"The Brooks Oil Story", a 30-min 16mm full-color sound film, deals with the production of specialized lubricants for industrial applications. It pictures and describes the research, manufacturing, and quality control methods used to produce the oil, and their use in steel mills and other industrial plants. The film is available without charge and arrangements can be made by contacting The Brooks Oil Co., 3304 E. 87th St., Cleveland, Ohio.

◆

"Machining Stainless Steels" is a film prepared by the Armco Steel Corp. dealing with the problems and solutions of working with these materials. Cutting speed, tool composition, tool grind, rigidity of setup, and other machining factors are discussed and illustrated. The film uses detailed diagrams to explain these points. For more information about this film write to Armco Steel Corp., 1457 Curtis St., Middletown, Ohio.

◆

A 16mm motion picture describing applications of Colonial Keystone Lock (CKL) blind rivets in aircraft structures is available from Huck Mfg. Co., 2480 Bellevue Ave., Detroit 7, Mich. The 12-min film entitled "Hold It" shows the assembly of a number of typical airframe units, illustrating the ease with which the CKL fastening process is accomplished. Special animated drawings and close-up slow motion shots are included to give a thorough understanding of the driving cycle of the blind rivet.

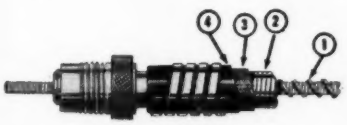
◆

High speed, high precision milling of small parts is covered in the 16mm color film, "The Millers That Use Their Heads." Production line sequences feature millers tooled for automatic and semi-automatic manufacturing operations on component parts in both ferrous and non-ferrous metals. Scenes were taken in plants manufacturing precision pumps, screw machine products, machine tools, and small cutting tools. The 24-min film is loaned free of charge by The Robert E. Morris Co., West Hartford 7, Conn.

New Hand Tool Gives Tool And Die Maker More Efficient Performance

At the Modern Tool and Die Company, Cleveland, extremely close tolerances are a constant requirement in the daily production activities. Workmen must have hand grinding tools which provide cool operation over long periods, vibration-free performance, flexibility and efficiency in use, and minimum handling fatigue.

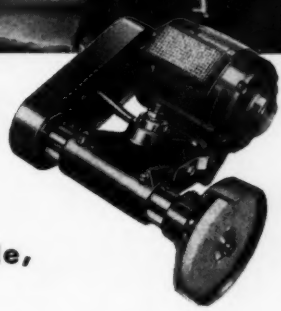
According to the Shop Foreman, the latest hand tool that has all these advantages is the Dumore Super-Flex shaft tool. "We like it because it takes all our ¼" and ⅛" shank tools and performs extremely well on our close tolerance tool and die work. Even after day-long use, worker fatigue is practically non-existent. It has cool operation and is vibrationless. The 22,000 rpm output gives us ample speed for clean, fast, precision metal removal. It is the handiest, most efficient hand tool we have."



BUILT-IN EFFICIENCY

Bronze liner encircles the shaft (1) which acts as a bearing and confines rotation within a definite radius. It prevents vibration, whipping and acts as lubricant to the shaft. The armored wire casing (2) is surrounded by wire braid (3) for further insulation and covered with neoprene (4) which is oil, grease and water resistant. For further information on the Super-Flex and other precision hand tools, write to the Dumore Company, 1304 Seventeenth Street, Racine, Wis. Adv.

Low Cost Precision Grinding Machines



made possible with versatile, all-purpose SERIES 5

DUMORE TOOL POST GRINDERS

MOUNTED ON USED MILLER BASES, the Series 5 Dumore Tool Post Grinders provide manufacturer, Scully-Jones, Chicago, with dependable high production precision grinding equipment at amazingly low cost.

As the plant manager says, "Over many years' use we have learned to expect very close tolerances, low scrap and trouble-free operation from our Dumore Grinders. The extremely low depreciation, maintenance and set-up costs make this unit one of the most satisfactory tools in the plant. As long as Dumore Grinders and serviceable used machine tools are available we need never lack for precision grinding equipment."

Series 5, Dumore Tool Post Grinder, ½ hp distributed field, continuous-duty rated universal motor. Speeds from 4600 to 42,500 rpm for wheels from ⅛" to 5". Performs a wide variety of internal and external grinding jobs at high production rates. Accuracies to .0001" and surface finishes of 6 to 8 micro-inches. For lathes with 13" to 18" swing . . . and . . .

Mounts on any basic machine tool — planers, shapers, mills, grinders, lathes — to provide precision grinding equipment at low cost. Simplified mounting makes change-over quickly — and speeds re-converting to original machine, when required. You can improvise, too, to make low cost special machines for special jobs!

Eight other models available, 1/5 to 3 hp, for every size of basic machine and type of grinding job. For complete details, write for Catalog 55-FL.

WARNING: If you own a Dumore Tool Post Grinder — don't let it sit idle in your tool crib! It's the most versatile, useful tool you own. Put it to work **now** — you'll save money and get better results!

SOLD THROUGH LEADING DISTRIBUTORS EVERYWHERE

You can do more grinding with Dumore Grinders on **any** machine tool!

DUMORE

PRECISION TOOLS

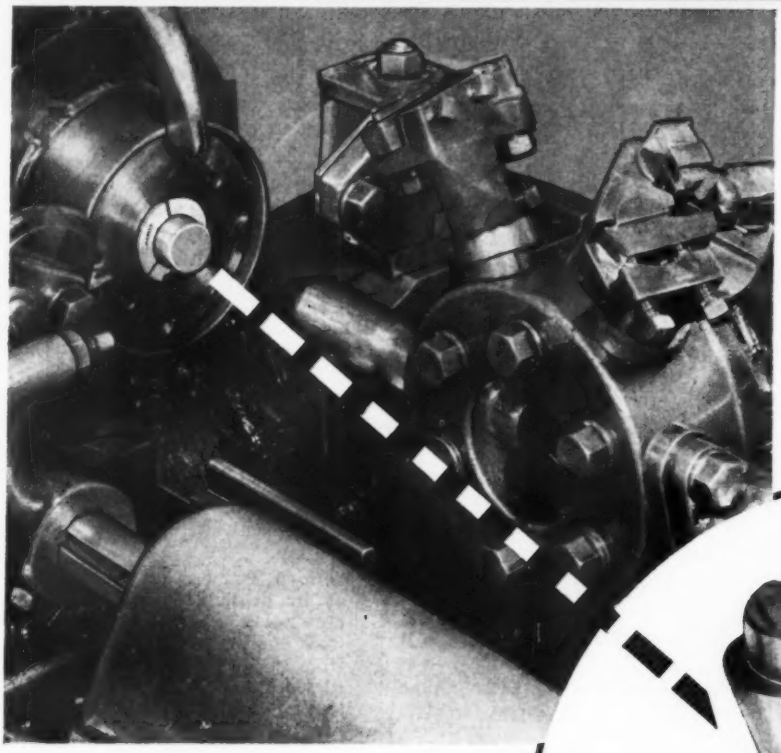
AUTOMATIC DRILL UNITS
TOOL POST AND HAND GRINDERS

1304 Seventeenth Street, Racine, Wisconsin

CIRCLE INFORM-A-GRAM KEY NO. 47

HARDINGE
ELMIRA, N.Y.

PRECISION PRODUCTS
for BROWN & SHARPE machines



COLLETS
FEED FINGERS
PADS

STOCK DELIVERY
FROM

Elmira, Boston, Atlanta,
New York, Hartford, Philadelphia,
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Detroit, Minneapolis, Chicago, St. Louis,
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Order From **HARDINGE** Today

One Source of Supply Means Purchasing Economy

Write for FREE Bulletin B&S

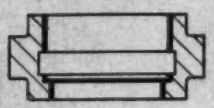
HARDINGE BROTHERS, INC., ELMIRA, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 48

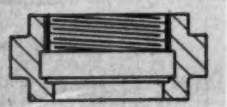
Bodine

case history no. 45

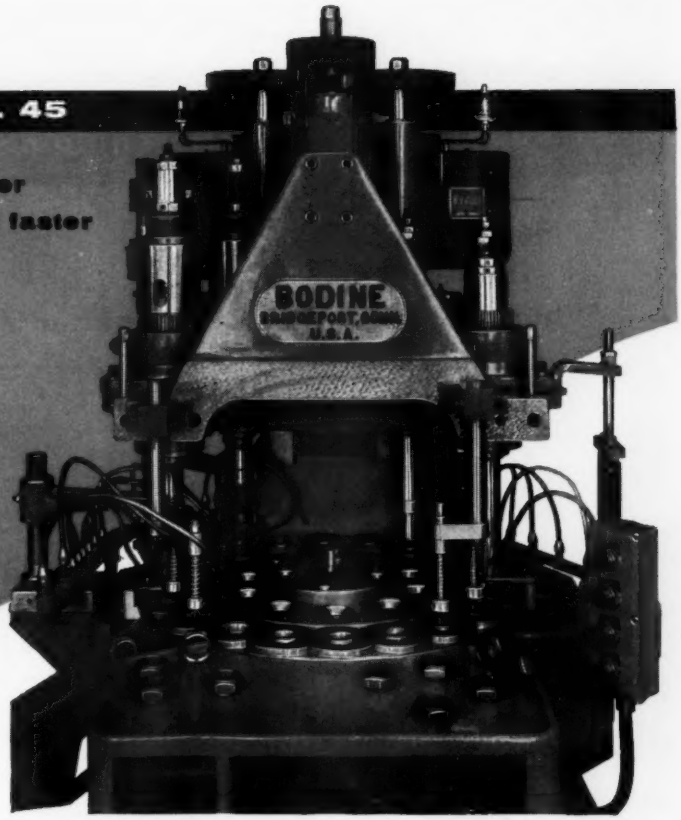
how DART makes better UNION NUTS . . . much faster



REAM and seat with combination tool



TAP . . . with collapsible tap (1.440-13 Thd; 1.703-12 Thd; 2.068-11 Thd.)



simplified, easily changed tooling handles sizes up to 2.068"-11 thread two at a stroke . . . 20-30 per minute

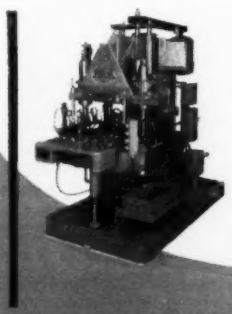
Not only does this Bodine 48-30 machine handle many size variations up to this husky maximum, it also makes much BETTER nuts because "floating" work holders have licked the problem of eccentricity in the castings.

Reaming is done with a carbide inserted-blade combination tool, the threading with a collapsible tap.

Changeover from one size of nut to another is quickly accomplished by changing cutting tools and inserts in the indexing dial. Bodine's standard 2" heavy duty flange mounted spindles are used.

Here's yet another instance where a Bodine Basic Machine and Bodine methods do a tough job much faster and much better at lower cost. Perhaps we can show you a way to do likewise. **Write Dept. TP-9.**

Production Data: Cast malleable iron nut sizes up to 2.068"-11 thread, machined 2 at a stroke . . . 1000 to 1500 pieces per 50 min/hr.



Is space a factor in your shop? This complete, compact Bodine production unit occupies only 5' x 8' of floor space.

THE **Bodine** CORPORATION
BRIDGEPORT 5, CONNECTICUT

AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

48087

CIRCLE INFORM-A-GRAM KEY NO. 49

Mr. Plant Engineer–

You're responsible for EFFICIENT air supply to pneumatic equipment

Here are
BRAND NEW
high-efficiency units . . . better air service . . . easier to maintain

Delivers really CLEAN dry air

Watts Filter delivers clean dry air to Federal Products Dimensionair.

High-Efficiency FILTER with exclusive "Tornado Action."

Extreme centrifugal force spirals dirt and moisture particles downward into the "quiet zone" leaving in the air only a minute percentage of the finest and lightest particles which are trapped by the filter cone.

Maintains MORE UNIFORM PRESSURE

Watts Regulator maintains uniform air pressure for Scott-Williams KN Knitting Machine

High-Efficiency REGULATOR with highly sensitive "Aspirator Action."

Watts Aspirator control acts directly on the diaphragm, giving instant compensation for fluctuating pressure demands . . . provides precise control and stabilizes pressures reaching individual pieces of equipment.

LUBRICATES perfectly at all flow rates

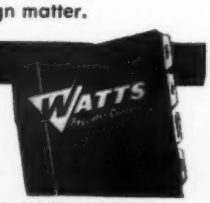
Watts Lubricator provides efficient lubrication for Markem Machine Company's Model 70AF.

High-Efficiency LUBRICATOR with exclusive "By-pass pick-up."

Watts new By-Pass Pick-Up makes possible a sub-miniature, high velocity venturi section which positively creates sufficient force — even at flow rates as low as one cubic foot per minute — to vaporize oil into a fine mist for uniform, economical lubrication.

BEFORE YOU MAKE ANY COMMITMENTS —
get the facts on Watts new-design units which open up new worlds of efficiency in Pneumatic Operation, Line Maintenance, and Protection of Equipment against foreign matter.

REQUEST CATALOG AND DETAILED SPECIFICATION SHEETS



WATTS REGULATOR COMPANY
SINCE 1875

14 EMBANKMENT ROAD LAWRENCE, MASSACHUSETTS

CIRCLE INFORM-A-GRAM KEY NO. 50

At Your SERVICE

Expansion of their tool grinding and modification service to industry is announced by the Niagara Cutter Div'n of North Tonawanda, N. Y. Manufacturers of integral shank type face mills, special diameter reamers, interlocking cutters, and end mills, they do special grinding on a wide variety of general and single purpose machines.

•

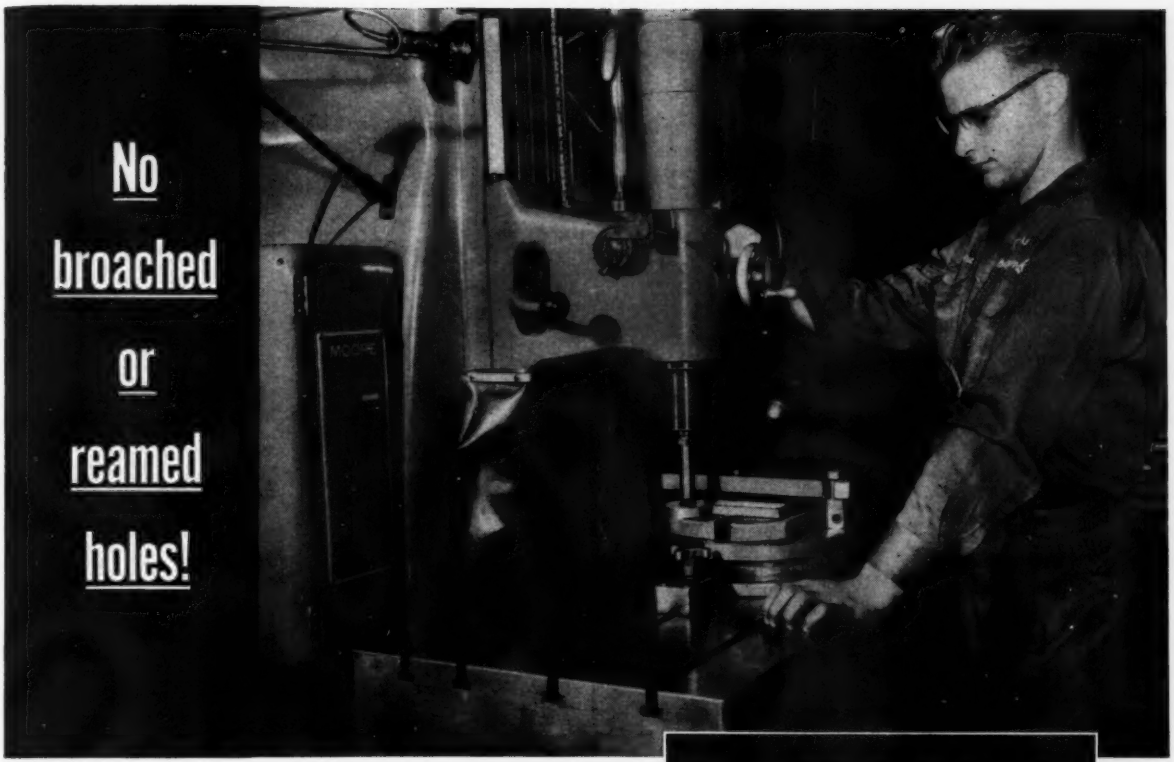
Shells, cups, cans, ferrules, and other eyelet machine products are now available from Process Metal Stamping Co., Los Angeles. The company makes its own tools and dies and is equipped to work in most metals. Speed, precision, and prompt delivery are achieved by the use of multiple plunger presses.

•

A new quality control production service is available to producers of powdered metal parts from Hoeganaes Sponge Iron Corp., Riverton, N. J. This free service offers a cooperative effort between powder producers and metal parts manufacturers to arrive at proven raw material mix specifications. Hoeganaes supplies a mix assortment of green bars, which are sintered under the manufacturer's normal conditions. Then the mix is tested and evaluated and sample mix and green tensile bars are furnished for additional test evaluations.

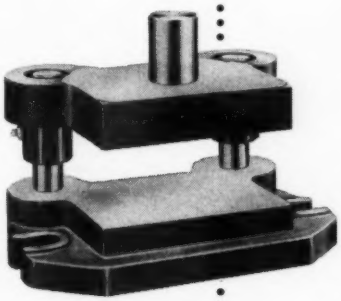
•

Jansson Gage Co. of Detroit, Mich. announces a new service to all manufacturers using gage blocks. They will produce special size gage blocks in either English or metric measure, made to customer's specifications. Choice of materials include special alloy gage block steel, tungsten carbide, cemented carbide, chrome carbide, chrome-plated, or other alloys. Swedish optical gage block comparators, accurate to 0.000001", are used in conjunction with the latest electronic measuring equipment to validate tolerances within ±0.000001". Sizes range down to 0.004" thick.



They're precision bored on master plates to give you absolute interchangeability between any die shoe or punch holder

DANNEMAN
PRECISION
DIE SETS



Danneman die sets are precision built every step of the way to assure long, trouble-free production accuracy. You can be sure of perfect alignment because we finish Thompson-grind all four horizontal sides . . . assemble with cylinder square fixtures to insure squareness of leader pins and bushings. Even the U-lugs are machined for additional clamping accuracy.

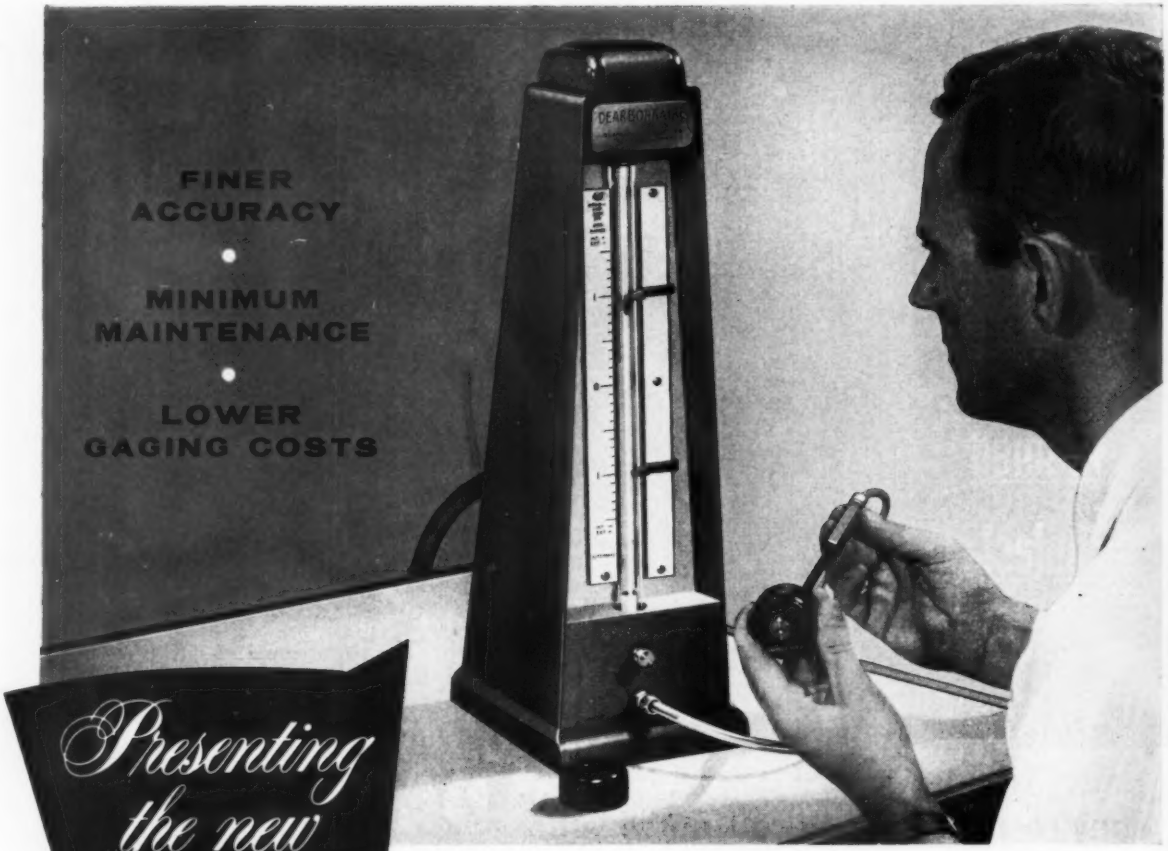
Bushings and leader pins with lubricating devices are Lamina precision hardened and ground — or if you prefer a low cost die set, we can supply regular plain hardened and ground steel bushings with lubricating grooves on the guide posts.

Specify *Danneman* precision die sets on your next job and *see* the difference. Catalog on request.

DANNEMAN
DIE SET DIVISION

ACME-DANNEMAN CO., INC.
Sales Offices: 45 West 18th St., New York 11, N. Y.
ALgonquin 5-7150 *Works:* 203 Lafayette St., New York 11, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 51



Presenting the new

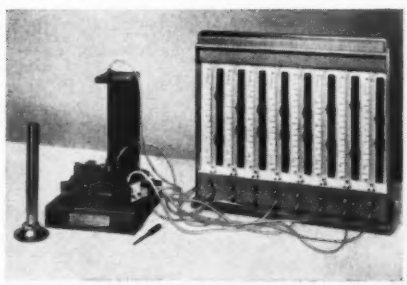
DEARBORNAIRE

COLUMN-TYPE AIR GAGING INSTRUMENT

Never before has there been an air gage instrument quite like the new Dearbornaire! For it incorporates a host of advanced design features that give you greater versatility and ease of operation with finer accuracy, minimum maintenance and lower gaging costs.

The characterized internal taper of its exclusive new glass tube assures positive linear accuracy over the full extent of the calibrated scales. Its zero-centered scales permit faster and easier reading . . . whether used for normal parts inspection, for statistical quality control, or as a tool setting gage. Interchangeability of its basic component parts simplifies conversion from one amplification to another . . . saves time, cuts costs. What's more, Dearbornaire's new higher rated pressure system and built-in circuit restrictions make it virtually self-cleaning . . . eliminate nuisance interruptions for service, reduce down-time to a minimum.

Single and multiple column instruments available now in standard amplifications of 1250-1, 2500-1 and 5000-1. Free demonstration arranged upon request. Write for complete information today!



Multiple column Dearbornaire instrument and a special fixture equipped with Dearborn contact cartridges to check eight close tolerance dimensions at one time.

AIR GAGE DIVISION **DEARBORN GAGE COMPANY**

22038 BEECH STREET DEARBORN, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 52

Cuts scaling time 60%

JOB: Removing welding flash on fabricated parts. Formerly used heavier, slower welding hammer and pick. Switched to rugged, fast-hitting Rotor S-1P Scaling Hammer.

RESULT: Reduced scaling time from 75 minutes to 30 minutes. Savings paid for new scaler in 60 working days.

Rotor S-1P is also ideal for peening, paint scaling, beveling of plates, light chipping and star drilling. Front exhaust keeps work clean. Push-throttle permits operator to rotate tool and chisel . . . start with a few blows and control blows up to 5000 a minute. Safety chisel retainer allows one-hand operation. Chisel bushing is replaceable. Available with three throttle handles: Push (S-1P), Lever (S-1L), Grip (S-1G).

Full details in Bulletin 54 . . . or ask for demonstration on *your* job. The ROTOR TOOL Company, Cleveland 32, Ohio.

Here's the RIGHT TOOL for YOUR job!

Rotor Air Tools: Assembly Tools • Drills • Small Wheel Grinders Straight Grinders • Vertical Grinders • Scalers • Chippers • Rammers
Rotor High-Cycle Electric Tools: Grinders • Polishers • Sanders

ROTOR TOOLS®
CLEVELAND, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 53

MAKE WESPO YOUR DESIGN STANDARD for ALL WORKHOLDING NEEDS

WESPO TOGGLE CLAMPS & PLIERS

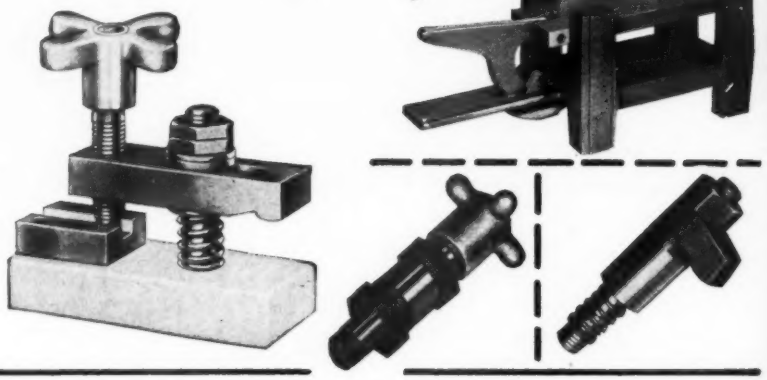
Over 80 types and sizes. From ⅝" Midget to 12⅝" Clamp. PLIERS — from 1⅜ Jaw Midget to 4¼ wide Jaw.

WESPO Toggle Clamps are made in types and sizes to meet all workholding needs, light, medium and heavy duty. Features include: REAMED HOLES, for better bearing, HARDENED BUSHINGS — SERRATED to prevent turning — HIGH TENSILE STRENGTH RIVETS for longer service.

WESPO FIXTURE CLAMPS

Over 170 Types and Sizes

WESPO fixture clamp assemblies save up to 70 percent on your own designing and machining. They are used as standard by a large number of leading manufacturers.



WESPO COMPONENTS

Over 1,000 types and sizes available from stock.

WESPO parts are precision manufactured of quality steel — heat treated and rustproofed. They are designed for heavy duty and long wear and have proved their value in many industries.

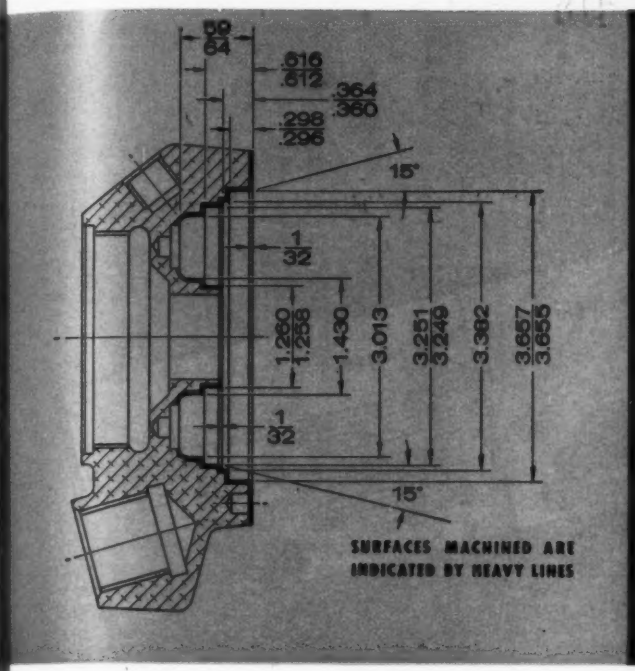
ADJUSTABLE SPINDLES FOR TOGGLE CLAMPS with BONDED NEOPRENE CAPS

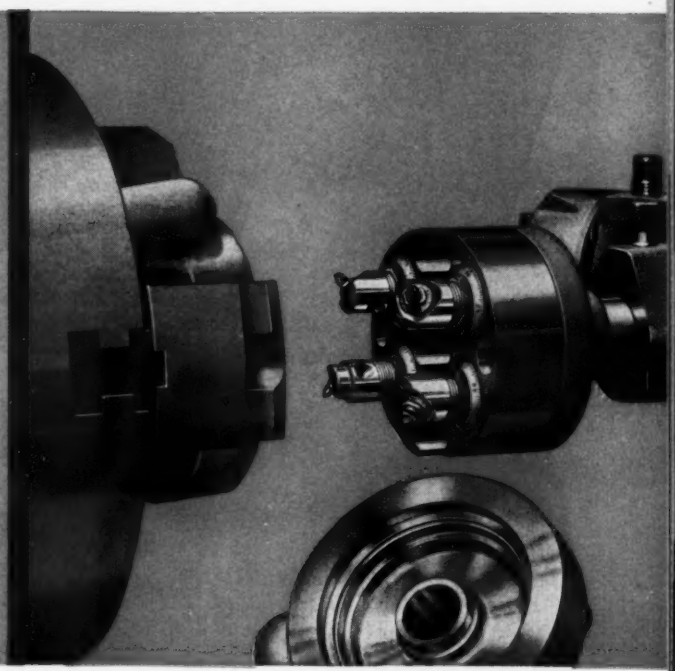
Write for Catalogs —
TOGGLE CLAMPS & PLIERS, FIXTURE CLAMPS and PARTS

WEST POINT MFG. CO.
26935 W. 7 Mile Road • Detroit 19, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 54

13 surfaces finish machined in 2 passes...





HERE'S HOW MICROBORE CLUSTER TOOLING DOES IT ON A TURRET LATHE!

This Special Microbore Production Tooling was designed for a well known hydraulic pump manufacturer to machine pump covers on a turret lathe. Operations include precision boring and turning thirteen diameters and faces in only two passes. Think of the costly manhours saved and down time eliminated in comparison with conventional, piecemeal methods of handling this same job.

ACCURACY IS AN ECONOMY—With the Microbore System of cluster tooling, independent precision adjustment of each Microbore tool point permits accurate settings in a matter of seconds. On piece after piece, machined surfaces are held to extremely fine limits.

Microbore is a versatile tool that can be applied singly or in clusters for all types of boring, turning and facing operations. Microbore also manufactures Standard Boring Bars, Boring Bar Sets and Microbore Flash-Change Tooling—the ultimate for quick change tooling.

Join the leaders who are already multiplying their profits with modern Microbore tooling and methods. Write for Catalog No. 56.

DeVlieg Microbore System

DE VLIEG MICROBORE • DIVISION OF DE VLIEG MACHINE COMPANY

2720 West Fourteen Mile Rd., Royal Oak, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 55

This 8-page illustrated booklet brings you up to date on the latest features in Waterbury Farrel's multiple station pillar presses. It explains the design improvements which provide greater efficiency, easier operator control, increased flexibility and economy of operation.

Includes complete table of specifications and capacities for six press sizes. Also covers accessory equipment such as straighteners, feeders, scrap winders, etc.

To get your copy, use the coupon or drop a line on your letterhead.

SOME OF THE MANY TYPES OF WATERBURY FARREL METALWORKING MACHINERY
POWER PRESSES — Crank, Cam and Toggle; also Rack and Pinion Presses • Eyelet Machines • Multiple Plunger Presses • Horizontal and Hydraulic Presses, etc. **MILL MACHINERY** — Rolling Mills: Strip, Rod, Wire Flattening, (For Ferrous and Non Ferrous Metals) • Also Slitters • Straighteners • Cut-off Saws • Coilers • Winders, etc. **WIRE MILL EQUIPMENT** — Continuous Wire Drawing Machines (Upright Cone and Tandem) • Wire Flattening Mills • Chain Draw Benches • Pointers • Swagers Bull Blocks • String-up Machines • Spoolers, etc. **COLD PROCESS BOLT & NUT MACHINERY** Headers (all types) • Rivet Machinery • Trimmers • Thread Rolling Machines • Slotters • Nut Formers and Tappers, etc.

WATERBURY FARREL
FOUNDRY & MACHINE CO.
Waterbury, Connecticut
Branch Offices: Chicago, Cleveland and Millburn, N. J.

WF-20

WATERBURY FARREL FOUNDRY & MACHINE CO.
Waterbury, Conn.

Gentlemen: Please send me my free copy of your Multiple Plunger Pillar Press Booklet.

*Name*_____

*Company*_____

*Address*_____

*City*_____ *State*_____

★ ★ ★ ★ ★ ★ ★ ★

Talk of the Month

★ ★ ★ ★ ★ ★ ★ ★

Organizing For Industry - Education Programs

by Robert L. Clark

Executive Director

The President's Committee on Scientists & Engineers

AMERICA IS AROUSED AS NEVER BEFORE to the urgency of this problem — the shortage of scientists and engineers. In community after community across the Nation, industrial, professional, civic, and labor groups are attempting to do something about it. But in the anxiety to solve the problem, I urgently implore community leaders not to smother our schools under a burdensome and confusing barrage of uncoordinated good intentions.

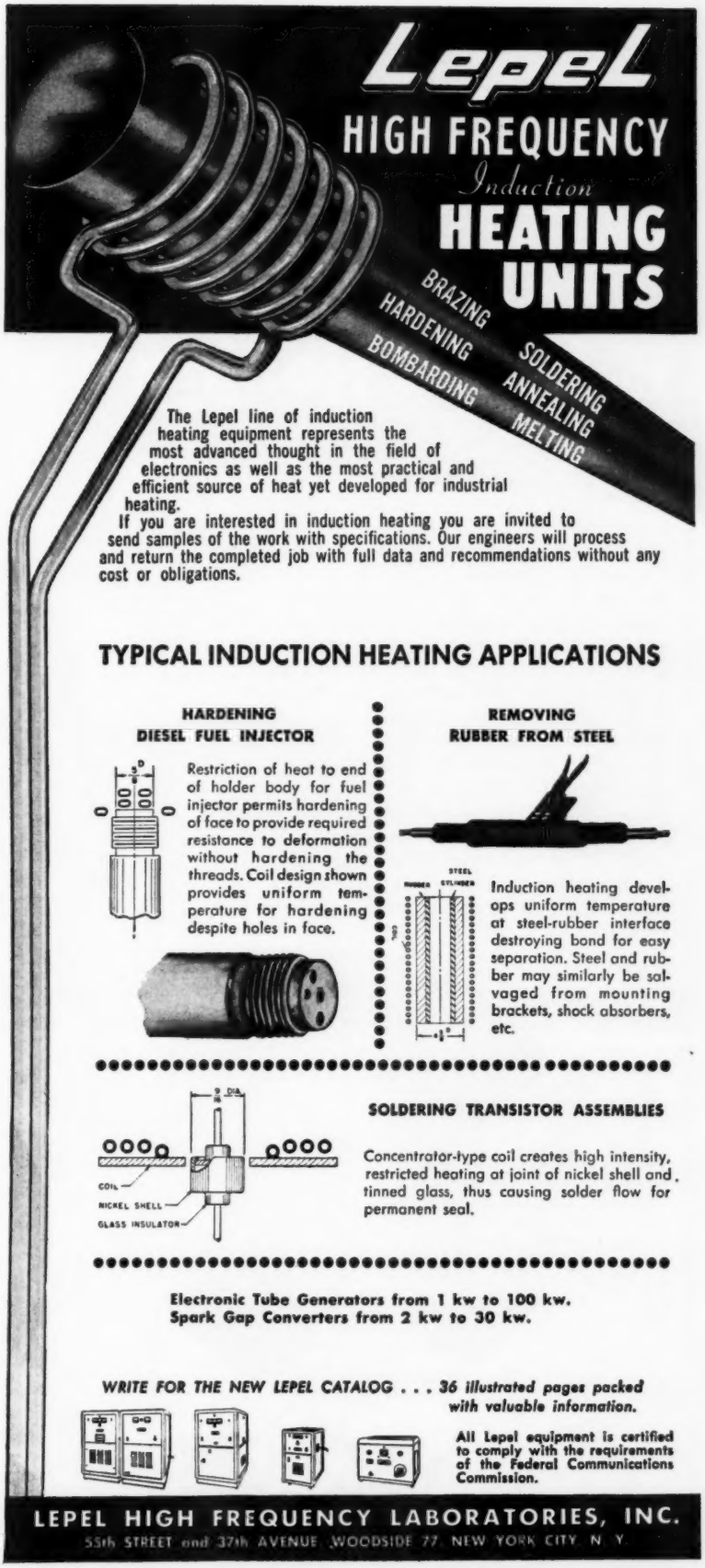
Every community has a diversity of resources for local action. They can be most effective when they are welded into a close-knit group moving together toward a common community objective, for our present national shortage of scientists and engineers can ultimately be solved only in the local classroom. In this instance, these resources for action include the school systems, industry and labor, the Chamber of Commerce, and other industrial and business associations, local chapters of the professional societies, civic and educational organizations.

The objective of the President's Committee is to develop a pattern for national effort without sacrificing the incentives and benefits of creative local action.

One of the Committee's chief functions is to serve as a clearing house for assembling and documenting local experiences, finding new ideas and uncovering new experiments, and making all these available to newly-developing local programs. It is hoped that this will accelerate

. . . *Continued on page 59*

Abstracted from this summer's Lake Arrowhead Industry-Education Conference, Lake Arrowhead, California.



The Lepel line of induction heating equipment represents the most advanced thought in the field of electronics as well as the most practical and efficient source of heat yet developed for industrial heating.

If you are interested in induction heating you are invited to send samples of the work with specifications. Our engineers will process and return the completed job with full data and recommendations without any cost or obligations.

TYPICAL INDUCTION HEATING APPLICATIONS

HARDENING DIESEL FUEL INJECTOR

Restriction of heat to end of holder body for fuel injector permits hardening of face to provide required resistance to deformation without hardening the threads. Coil design shown provides uniform temperature for hardening despite holes in face.

REMOVING RUBBER FROM STEEL

Induction heating develops uniform temperature at steel-rubber interface destroying bond for easy separation. Steel and rubber may similarly be salvaged from mounting brackets, shock absorbers, etc.

SOLDERING TRANSISTOR ASSEMBLIES

Concentrator-type coil creates high intensity, restricted heating at joint of nickel shell and tinned glass, thus causing solder flow for permanent seal.

Electronic Tube Generators from 1 kw to 100 kw.
Spark Gap Converters from 2 kw to 30 kw.

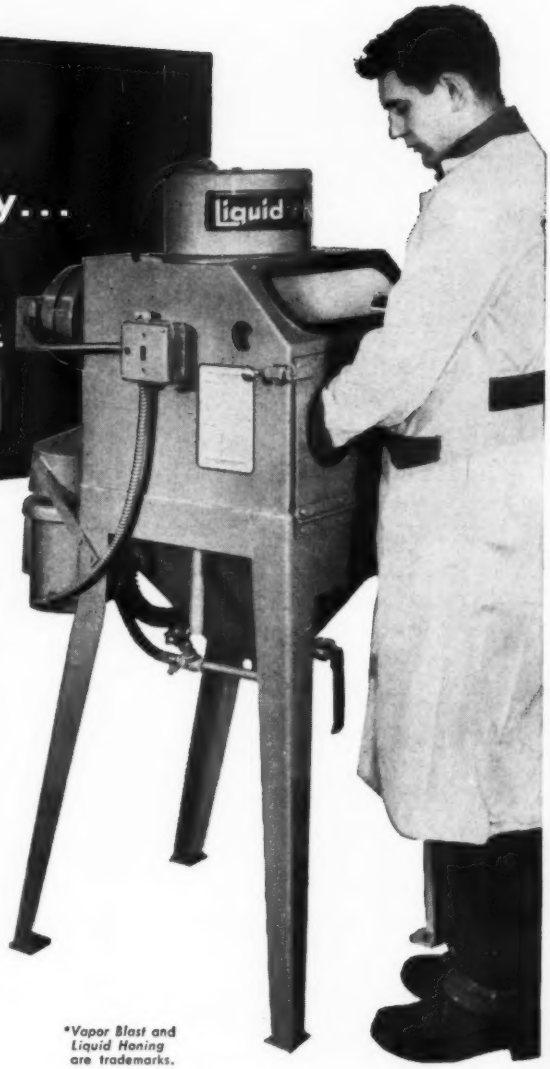
WRITE FOR THE NEW LEPEL CATALOG . . . 36 illustrated pages packed with valuable information.

All Lepel equipment is certified to comply with the requirements of the Federal Communications Commission.

LEPEL HIGH FREQUENCY LABORATORIES, INC.
55th STREET and 37th AVENUE, WOODSIDE 77, NEW YORK CITY, N. Y.

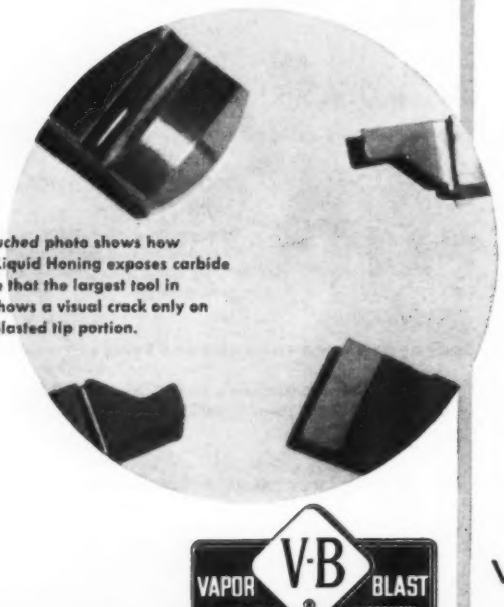
CIRCLE INFORM-A-GRAM KEY NO. 57

Detect Carbide Cracks Quickly, Positively... with V-B Liquid Honing*



Now you can prevent profit losses traceable to new or reground carbide tools that break because of cracks, porosity and other imperfections. Liquid-abrasive action flushes out the fine sintered material which, under grinding heat and pressure, often seals minute cracks and prevents detection by other methods. After Liquid Honing, fissures and other defects become *visually apparent* in a satin matte finish that remains dimensionally the same as the previous finish. Liquid Honing inspection processing is fast and thorough — more than 100 single-point tools per hour. And those tools, if not defective, last longer and cut better because they're free of burrs.

*Vapor Blast and Liquid Honing are trademarks.



This *unretouched* photo shows how effectively Liquid Honing exposes carbide cracks. Note that the largest tool in the group shows a visual crack only on the Vapor Blasted tip portion.

A Liquid Honing machine for carbide crack detection serves you in many other ways. Use it for surface conditioning, finishing, cleaning or descaling — often at production savings of 65% to 80%!

Write for complete information on case histories and low cost — only $550 to $1500 for a standard machine. And send a sample tool or part for free demonstration processing.

VAPOR V-B BLAST
MILWAUKEE WISCONSIN

VAPOR BLAST MFG. CO.
3131 W. Atkinson Ave. • Milwaukee 16, Wis.

CIRCLE INFORM-A-GRAM KEY NO. 58

. . . Month's Talk from page 57

action to meet the problems which are growing ever more acute.

Grassroots community action doesn't simply ignite by spontaneous combustion. It must grow out of a need which stirs somebody to action. Sometimes it results from the initiative and enthusiasm of an individual. Sometimes it is initiated by a public-spirited business concern. In other cases local programs are generated by the schools, the service clubs, or the professional societies.

However it happens, it demonstrates a recognition of community responsibility. And a recognition that in the long term, the critical needs of the nation will be met at the local level — by action in the cities and towns of America. The Indianapolis Chamber of Commerce has, I believe, best summed up this responsibility of the local community in a message sent to its members:

"Obviously, we can't here in Indianapolis solve the whole problem, but we **can** solve it in our own area — and thereby contribute to a national solution."

Indianapolis Starts Community Action

The Indianapolis program is an outstanding example of the way industry can take the lead in generating community action. Indianapolis is an industrial community of some 1,100 business establishments supporting a population of nearly 700,000 people. The shortage of scientists, engineers and technicians was felt there early, and E. B. Newhill, general manager of the Allison Division of General Motors, saw the pinch reflected on his own production lines.

On May 4, 1956, Mr. Newhill called on school administrators and science and mathematics teachers of the Indianapolis area to meet with representatives of the city's leading industries. Out of that meeting was born an "Industry-Schools Committee on Science and Mathematics Education."

The Committee posed a number of searching questions about the area's schools. The Allison firm employed a group of Indianapolis science and mathematics teachers during the following summer to work out some of the answers. At the same time, the Indianapolis newspapers were stimulating public interest in the problem. By the time schools opened in the Fall, representatives of every segment of Indianapolis life were enthusiastically taking part in a community-wide project which soon produced these concrete actions:

- The Indianapolis School Commissioners appropriated an additional $56,000 for portable laboratory demonstration tables and other equipment for the junior high schools. An extensive program of

. . . *Continued on page 61*

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SURFACE PLATES . . . • Specially heat treated cast iron to eliminate distortion and to insure dimensional accuracy . . . triangular rib supported to resist load deflection . . . finished to exacting precision specifications . . . ample top thickness to permit resurfacing operations.

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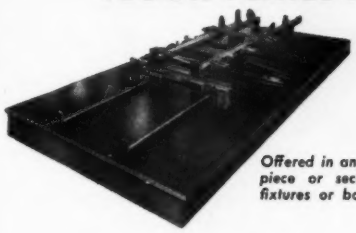

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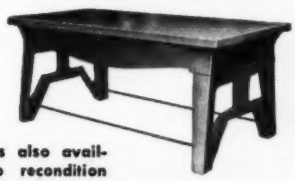

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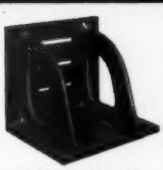

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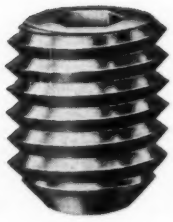
CIRCLE INFORM-A-GRAM KEY NO. 59

how to keep costs down



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CIRCLE INFORM-A-GRAM KEY NO. 60

. . . Month's Talk from page 59

in-service education was established for junior high school science teachers.

- A program of visits to local industrial plants and laboratories was set up for science students and teachers.
- The Chamber of Commerce raised $10,000, making it possible for local science teachers to attend national and regional conferences, and to take refresher courses at Purdue University. The Chamber also financed participation by outstanding Indianapolis students in the national Science Talent Search.
- The Chamber of Commerce arranged summer employment in local industries for science and mathematics teachers.
- A series of "Seminars in the Sciences" was held during the school year to hear outstanding speakers provided by Purdue University. Attendance was limited to science and mathematics teachers, industrial personnel, and selected students.
- Experimental television programs were launched for junior high school science students, followed up and evaluated by written examinations.

These are short-term programs. Perhaps most important from the long-range viewpoint is that the citizens of Indianapolis, who had long suspected they were short-changing their school system found that, when subjected to critical study, science and mathematics education was seriously deficient. The entire system is now being modified to meet the special needs of today's increasingly technological world.

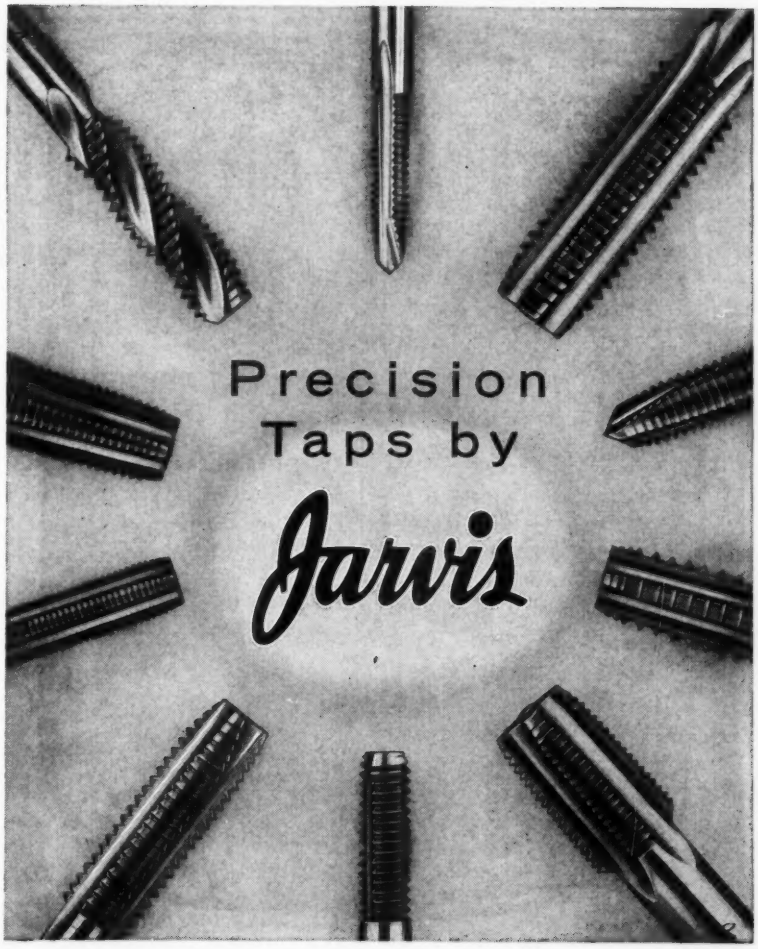
Community Approach Is Flexible

The program of the International Paper Company — an outstanding example of industry action — reaches into nine States, but it remains a program of community action. The International Paper Company Foundation is aiding the local school systems of 13 communities in five southeastern and four northern States. Chief objective is to awaken community-wide interest in public school improvement through a flexible approach that differs according to the needs of each community and is guided by a policy of non-interference with school authorities.

Last summer, the Foundation financed two six-week workshops in math and science instruction for 64 teachers from 44 schools. In a follow-up survey, the Foundation found that the workshops had "paid off" in these ways:

- Science Fairs were held in schools for the first time.
- Local school systems provided more equipment and teaching materials.

. . . *Continued on page 63*



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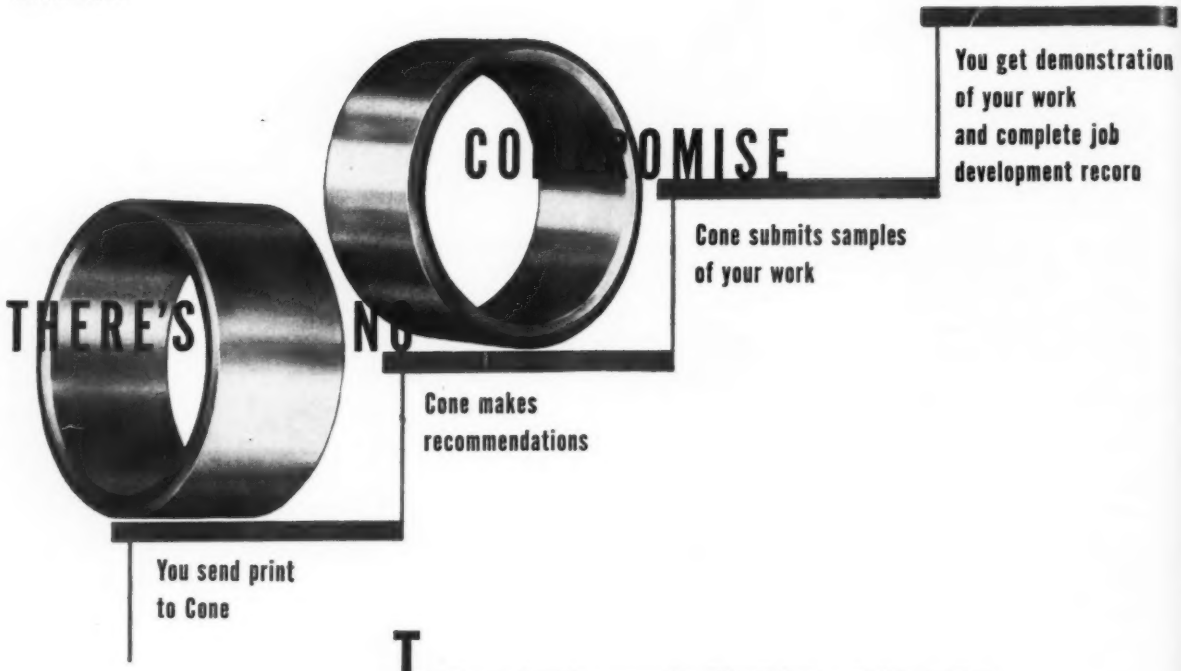
CIRCLE INFORM-A-GRAM KEY NO. 61

No. 6 in a series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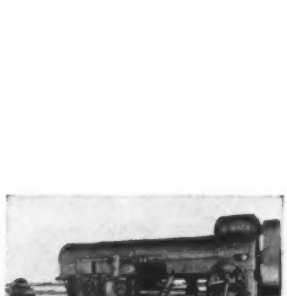
Tools.....100% Carbide Tipped	RPM.....825
Material.....8620	Time.....14.8 Secs.
Stock Size.....1⅝"	



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CIRCLE INFORM-A-GRAM KEY NO. 62

. . . Month's Talk from page 61

- Class teaching practices were improved.
- **Local** summer workshops were set up for teachers.
- Teachers in fields other than science and mathematics have requested similar workshops.

This year the summer workshop plan, which is only part of International Paper's overall program, is being expanded to include 75 teachers and administrators from 15 school systems in six southeastern states.

I think it pertinent to quote John Hinman, chairman of the board of International Paper, who earlier this year told the National Citizen's Council for the Public Schools:

> *"Ours is far from being a proven program. But I think we have established that it is quite possible and practical for industrial citizens to stand beside individual citizens in support of their public school systems . . . We think that the broad pattern that is being worked out in our communities may suggest patterns and avenues that other companies may develop."*

In Kansas City (Mo.) a single individual was the "spark plug" of the local program: Dr. Max Thornton, Technical Director of Midwest Research Institute. After a somewhat discouraging experience as manager of the city's Science Fair last year, Dr. Thornton resolved that something had to be done to improve science and math teaching. He organized Science Pioneers, Inc., supported by local corporate subscription.

Today, the students of 350 elementary and 35 high schools in the Kansas City area are benefiting from the guidance of Science Pioneers, which operates on an annual budget of $18,000, a third earmarked for Science Fairs. A former Kansas City teacher, Leo J. Roedl, is executive director. He maintains a speakers' bureau and renders counseling service to teachers and students, assisted by a large corps of volunteers.

In Washington (D. C.) where 20,000 scientists and engineers are centered in Government and private research, the professional societies took the lead in stimulating community action. In 1949 the Washington Academy of Science, representing 20 local scientific bodies, formed a "Committee for the Encouragement of Science Talent." The Committee was at first chiefly concerned with Science Fairs and the Science Talent Search. The Council of Engineering and Architectural Societies, representing another 20 professional organizations, developed a similar interest in 1953. Two years ago they combined forces to establish a "Joint Board for Science Education" which is now working with 125 public, private, and parochial secondary and elementary schools in the Washington area.

Ways to Help Are Unlimited

Financed by local industry, the Joint Board's activities include a speakers' bureau, free use of films on engineering as a career, cash awards to outstanding science teachers, and a school contacts committee, with a scientist serving as liaison officer with each secondary school in the area. Of particular interest is a series of career guidance conferences for high school students. Outstanding leaders in each field of science and engineering served as speakers and advisers. The Joint Board has also arranged on three occasions for as many as 750 scientists and engineers to substitute in the classroom for teachers while the teachers attended national and regional professional meetings.

Another enterprising community in which professional groups are helping school authorities in Shreveport, La. In this Deep South city, a program with 55 secondary and 102 elementary schools has been underway for nearly a year. Claude N. Valerius, a consulting petroleum geologist, persuaded representatives of 24 scientific and professional organizations to join with educational authorities and the Academy of Science in forming the Science Education Council. An interesting feature of this plan is the employment of a part-time administrative staff.

. . . *Continued on Page 64*

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CIRCLE INFORM-A-GRAM KEY NO. 63

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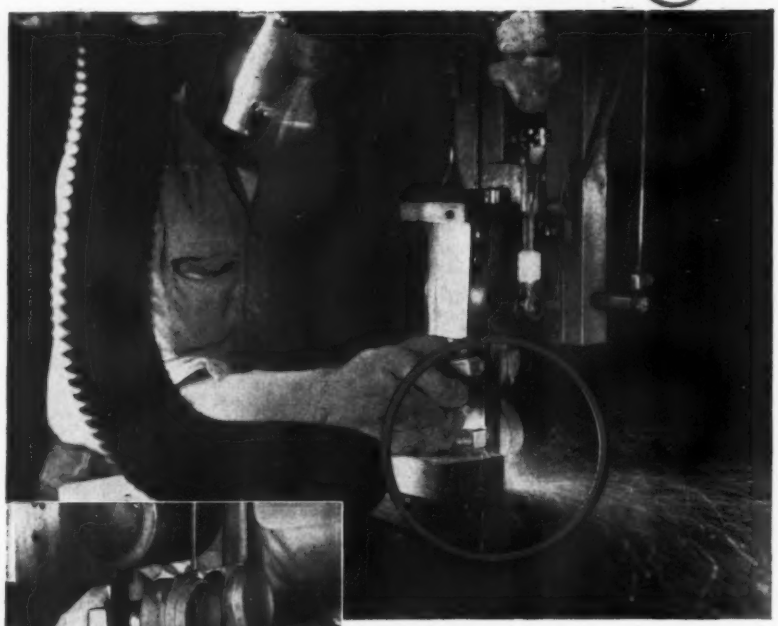

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CIRCLE INFORM-A-GRAM KEY NO. 64

. . . Month's Talk from page 63

In addition to providing career guidance for students and promoting Science Fairs and clubs, the Council finds summer employment for qualified students and maintains a lending library of teacher aids for classroom use. This summer the Council is presenting a series of 13 educational programs over a Shreveport television station. Panels of scientists to discuss scientific education are being organized now for PTA meetings next year.

In North Carolina, educators themselves took the lead in improving the State's science and mathematics teaching, which they were the first to recognize as inadequate. A statewide conference at Duke University last year resulted in the appointment by Gov. Luther Hodges of a permanent "Committee on Science and Mathematics Education," which is cooperating closely with the President's Committee in a "pilot project" expected to produce a pattern adaptable to the needs of other States across the country.

The program is now principally supported by funds originating in the State, with professional societies and North Carolina industry actively cooperating. One novel feature is a system of "science circuit-riders" — traveling teachers who spend several days in each school to work with the local teachers in motivating students with the highest potential and with clear scientific aptitude to consider careers in science and engineering.

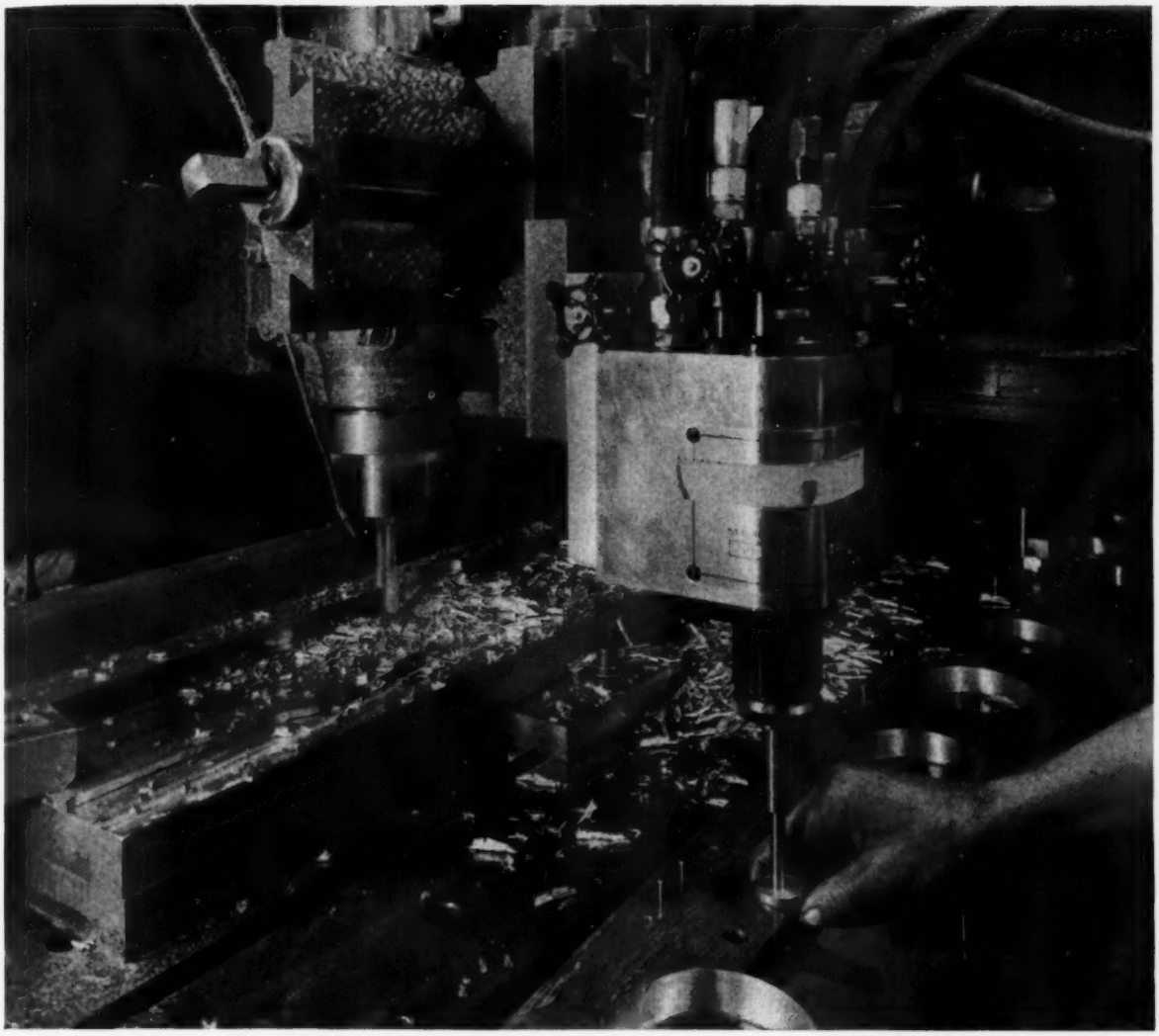
A Cross-Country Look at I-E

I have cited these community programs as typical of differing approaches which are operating successfully in various parts of the country. The list is by no means all-inclusive. Here, briefly, are a few other areas in which significant progress is being made:

• In Pennsylvania, Dr. H. A. Neidig, Chairman of the Chemistry Department at Lebanon Valley College, initiated a program to improve chemistry teaching. His program now reaches the students of 42 high schools in three neighboring counties. The college campus serves as a center for experiments by high school science clubs and discussion groups for chemistry teachers. The program, jointly sponsored with the American Institute of Chemical Engineers, is especially effective in this predominantly rural area.

• Teaching in all public high schools in the area surrounding Buffalo, N. Y., is benefiting from the activities of the Niagara Frontier, which is sponsored and financed by 40 local industries with the cooperation of the American Chemical Society. It features an in-service training program for teachers, for which they receive two units of post-graduate credit from the State Education

. . . Continued on page 66



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CIRCLE INFORM-A-GRAM KEY NO. 66

. . . Month's Talk from page 64

Department. The program also provides special out-of-school training for students with the highest science potential.

• In Massachusetts, Arthur D. Little, Inc., organized the "Lexington Plan" in 1956, under which an industrial concern and a high school jointly hire recent graduates in a technical field. These graduates alternate between teaching and professional work for three years. As a result, young people who might otherwise not enter teaching are enabled to enter the profession by increasing their income during early teaching years. The Raytheon Company and Sylvania operate modified forms of this plan.

• Providing summer employment for teachers to supplement their income and experience has become a major project — industry cooperating with educational authorities — in virtually every major community in the country and in a great many smaller towns as well. In some cities summer employment is also being provided the ablest high school students. In each case an attempt is made to assure that the nature of employment contributes to the education or professional development of the teacher or student. A recent survey by the National Science Teachers Association shows that of nearly 100 major companies, 94% employ teachers during the summer on a regular or part-time basis. The total number of such programs has increased five times in the past seven years. Summing up the usefulness of the program to industry, J. C. Sander of Boeing Aircraft says simply and succinctly: "The teachers pay their way."

• In the Toledo (Ohio) area, the Chamber of Commerce holds annual "exchange days," when teachers visit nearby plants and firms and, in turn, play host to industrial and business people visiting schools. Both groups acquire a closer understanding of the other's problems.

• Business and industry in Georgia pay the expenses and fees of 25 nationally-known consultants to the Atlanta Area Teacher Education Service, which strives to improve teaching methods. They give an "Oscar" to an outstanding teacher.

• The aircraft division of Goodyear Tire and Rubber Company gives summer assignments to most of the science and mathematics teachers in the school system of Litchfield, near Phoenix, Ariz. Each year, Goodyear sends half the teachers to the University of Arizona for refresher courses, employing the other half directly in technical work. The following year, the groups reverse roles.

• Boeing Aircraft in Seattle, Wash., maintains close liaison with the school system and with the Uni-

. . . Continued on page 69

You learn a lot in a hundred years... especially in the hundred just passed

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CIRCLE INFORM-A-GRAM KEY NO. 68

. . . Month's Talk from page 66

versities of Seattle and Washington, hiring engineering and scientific faculty for summer work.

Each of these programs has its individual characteristics. Each was developed to meet a local need, using the resources at hand. Each brings together and uses, in its own way, the community forces for action.

What Your Local Program Needs

I have described some unilateral and some multilateral approaches to the local problem. They are all first-rate endeavors. Now we are looking ahead to the next steps and to the joining of forces. What should we keep in mind?

The President's Committee has come to some conclusions, based on our experiences and on the observation of local programs over the country. Here are at least the basic elements we have come to believe are essential to a successful local program:

1. Broad representation of all forces for community action. Bring together not only the schools, industry and the professional societies, who have an obvious direct concern, but the labor unions, civic groups, neighboring colleges and universities, State education agencies, newspapers, and radio-television stations. All these are valuable resources for community action.

2. A single approach to the schools. Classroom teachers and school authorities are besieged with many demands upon their time. Get the support of the very people you're trying to help by making **one** contact with the schools through your community group. Have a year-round liaison representative assigned to each school in the district. Find out how your school system goes about developing its programs. Your efforts can easily break down if there are multiple approaches to the schools from different groups.

3. A close-knit organization with good communications. Plan your organization with clear-cut assignments to its constituent members. Set up good communications through a periodic newsletter or bulletin which keeps the members informed, provides a continuing report on activities, and records progress toward program goals.

4. Individuals who are willing to work and carry through to final objectives. A key element in any community organization is a "spark plug" who is willing to work himself and has the organizing ability and enthusiasm to get others to work as well.

5. An office with a fixed mailing address and telephone as the coordinating mechanism. An office provides the focal point for action. It should provide central services such as a speakers' bureau, publication of the newsletter, a repository for films, publications, exhibits and equipment on loan.

6. Maintain an open door for other individuals or organizations interested in your objectives. After getting the program underway, you may find interested individuals or organizations who have not previously participated. They may want to join you on a permanent basis or they may have special skills for carrying through a special project. The local medical society or the newspapers and radio-television stations are examples.

7. And finally — look ahead to the time when your local efforts may be the basis for moving to a State organization, when other communities will join with you in a Statewide effort. An organization plan, program goals and methods, and other records will be of great help in guiding the organization of a state or other community programs.

end

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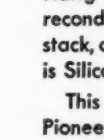

Harig Manufacturing Corp.

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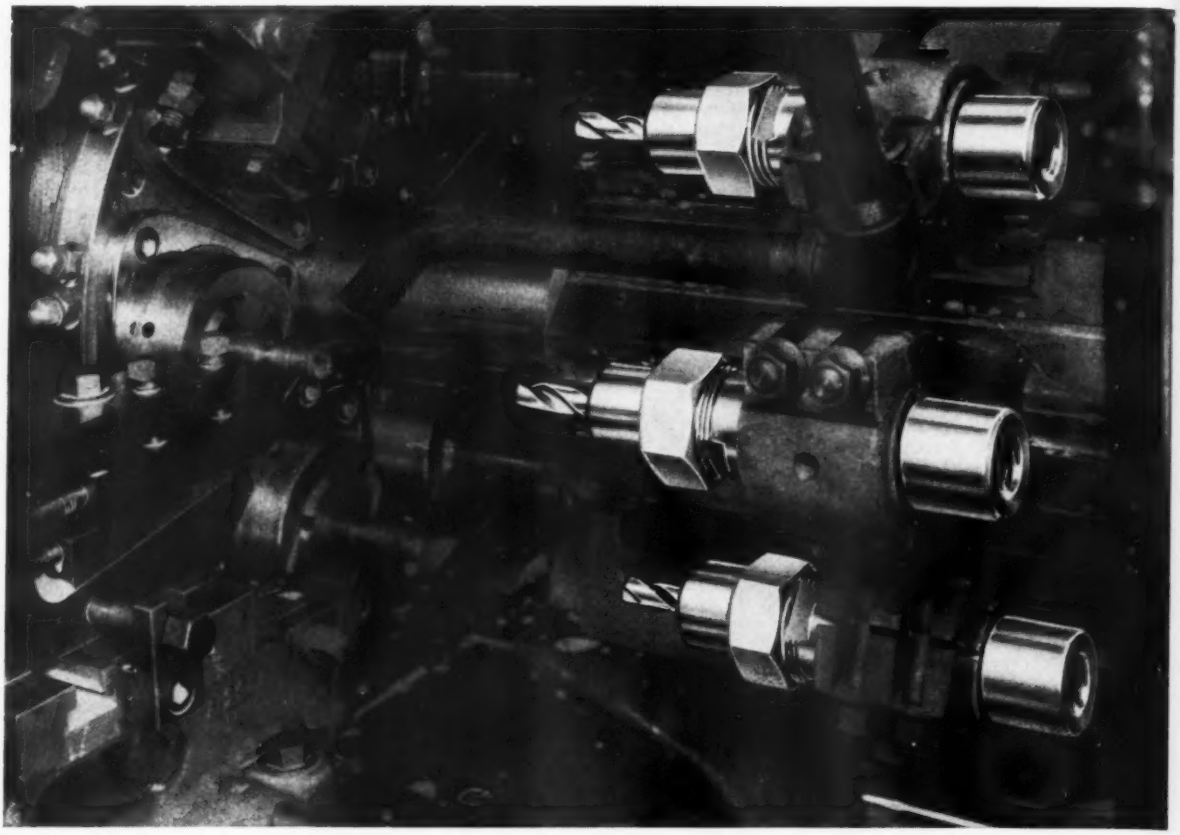

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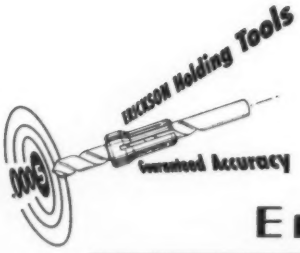

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ERICKSON TOOL COMPANY

2301-9 Hamilton Avenue • Cleveland 14, Ohio

editorial:

1958's Car Battle

HERE'S THE LAST CHANCE to get in our two cents worth on the automobile industry's upcoming battle for the 1958 consumer dollar before the new models start debuting.

From where we sit, it is shaping up to be a battle the like of which the industry has never enjoyed (?) before!

First of all, you just can't add eighteen models to today's car shopping list and not upset a few apple carts. This is what Ford is doing with the Edsel, and with good reason, as far as Ford is concerned.

With the demise of the rather unlamented Continental Mark II (it's bumped into the Lincoln stable), Ford would have only three names to play with, i.e., Ford, Mercury and Lincoln. These, against Chrysler's Plymouth, Dodge, DeSoto, Chrysler and Imperial, and General Motors' Chevrolet, Pontiac, Buick, Oldsmobile and Cadillac.

A great portion of today's automobile marketing theory and practice is based on the ideas of "trading up" and "staying within the family." As the Plymouth owner prospers, he is supposed (statistically, at least) to have his eyes set on ultimately owning an Imperial. By the same token, some of today's Chevrolet owners are conditioned into believing that a merry Oldsmobile is but a stepping stone toward the driver's seat of a Cadillac.

Compared with these prescribed paths to affluence, the Ford owner has had rough going. As the Detroit market analysts and ad men charted his course from Ford, through Mercury, to Lincoln, he was subject to constant sniping by brazen entrepreneurs from DeSoto, Pontiac, Chrysler, Oldsmobile et al.

Additionally, Nash, Hudson and Studebaker-Packard marksmen maintain a constant open season on Ford-Mercury-Lincoln adherents.

Now, with the advent of the Edsel, occupying a wide band of the price spectrum, the Ford family circle is so greatly enlarged that (they hope) there will be less straying from the fold!

Thus the battle lines are drawn and there is no lack of ammunition. The automobile industry's efforts are to give more car for the money (as well as more car for more money, now that the "low priced three" cost more than Cadillacs used to).

With the "horsepower race" relegated to the unmentionable by the AMA, it is possible that the car makers have missed a bet by not admitting how much of today's horsepower is diverted by the array of power-consuming accessories that are becoming standard equipment on so many models. First and foremost, though, these are selling features and serve as high-powered sales ammunition.

In any batch of ammunition there are bound to be some duds, and these serve to point up what an intricate aggregation of complexities the 1958 automobile presents. What sounds simpler than pushbutton transmissions? But when you consider that those pushbuttons may actuate servo-motors to effect the shift, it seems that dealer service personnel are being handed something not exactly on a silver platter!

Likewise, air suspension, thermostat-clutched fans, dual headlights, fuel injection, air conditioning and ventilation controls that look as "simple" as the console of a pipe organ, to say nothing of self-converting convertibles, all herald the passing of a great American institution, the backyard mechanic.

Detroit has most successfully isolated its product from the do-it-yourself movement. Now, we work for our cars, instead of on them!

Like any major battle, 1958's car battle will be attended by forays and skirmishes. These raids will be conducted by the foreign car troops.

A short time ago, the Detroit hierarchy ascribed but a minimum nuisance value to the compact, lively, 35 mile-per-gallon, foreign car package. At most, Detroit conceded that a foreign car sale meant that one of the boys on automobile row had missed the boat by not selling a good American used car.

Now, some 200,000 foreign car imports later, 1958 seems destined to see Pontiac and Buick dealers offering General Motors' European Vauxhalls and Opels. British Ford's Anglias and Prefects are no longer novelties on our streets, and are highly appreciated in our parking mazes. Then there is the Michigan (of all places) Cadillac dealer who works the old "How are you fixed for blades?" routine. He sells his customer a Cadillac; then a Volkswagon, just as a casual afterthought.

These are but trends, but no one can say that Detroit is averse to capitalizing on a trend.

We don't know how many car salesmen there are in this country. But we do predict that for them there will be no dull moments in 1958!

E. Willard Pennington

editor

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costs less than you may think

Check these sensible prices on the . . .

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air valve series

The line designed for extra long life. Lab tests indicate life of Silvermodels and Whitemodels: 25 million cycles; Goldmodels and Bluemodels: 40 million cycles.

(Quantity and OEM discounts reduce these prices)

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3/8" Straightway, normally-closed, line mounted, JIC Spool Solenoid (Silvermodel) **34.50**

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The Heat Treatment of Precipitation-Hardening

TOOLING & PRODUCTION Magazine

STAINLESS STEELS FOR HONEYCOMB STRUCTURES

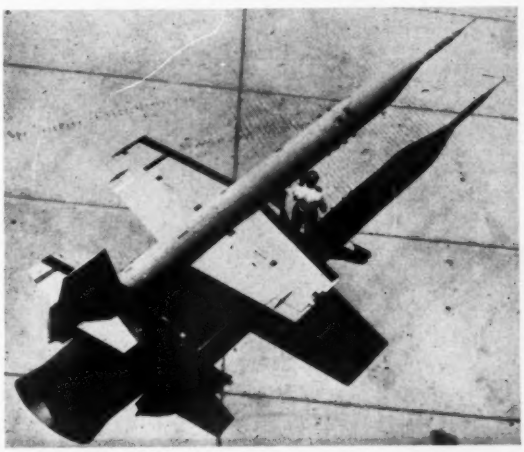
by Allen C. Gilbraith
New York City

To meet the requirements of higher-Mach modern aircraft, honeycomb structures using new precipitation-hardening stainless steels are taking on growing importance. The procedures developed here for heat treatment of these materials should be of value on other applications of the alloys, where high physicals are required at temperatures up to 900°F.

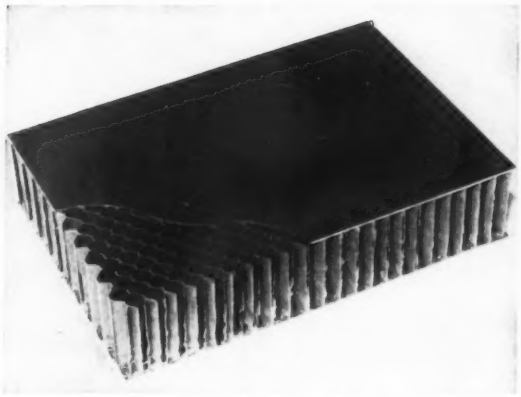
EVER SINCE the invention of the airplane, aircraft designers have been searching for a type of structure and a material for that structure that would supply the twin advantages of (a) increased strength-weight ratio, and (b) improved rigidity.

For a long time, the answer to the problem remained obscure. Then, three separate developments — the production of new high-strength stainless steels, the perfection of techniques for rolling these steels to ultra-thin gauges with extremely close tolerances, and the refinement of the metallic honeycomb structure — were fused in the white-hot urgency of the nation's supersonic aircraft and guided missile programs to produce the ideal structural material for multiple-Mach aircraft: the ultra-thin, stainless steel, honeycomb structure.

The honeycomb is formed by joining zigzag ribbons of ultra-thin stainless together at their nodal points to form the typical cellular structure. The form of these cells vary from the regular hexagon found in nature to the design produced by the intersections of sine curves. This cellular construction constitutes the



The U. S. Air Force's X-7, playing a major role in development of new engines for ramjet missiles, is typical of the higher-Mach craft in which the new stainless steels meet severe temperature and corrosion conditions.



Typical honeycomb structure employing new precipitation-hardening stainless steels that solve the designers' need for a high strength-to-weight ratio, plus unimpaired operational characteristics up to 900°F.

honeycomb "core." The facings, which sandwich the core, are sheets of somewhat thicker stainless (but still extremely thin by ordinary standards).

Made up of these relatively frail sections, the honeycomb nevertheless possesses an extraordinary strength-weight ratio, plus outstanding rigidity. For example, stainless steel facing sheets, when supported by a honeycomb core, can resist stress up to the point of full yield without buckling — which, in the case of one new experimental stainless, approaches 300,000 psi; and these facing sheets, when supported by honeycomb cores, are 16 times more rigid than when unsupported.

It is apparent that this type of structure can be composed of other types of material than stainless steel. As a matter of fact up to 1954, honeycomb cores were composed of balsa wood, foamed chemicals, plastics, glass fibers, impregnated paper, impregnated cotton, and principally, aluminum. But, in 1954, planes and missiles began to push into the multiple-Mach area, and, as they did, their engines became giant heat converters. The atmospheric gases through which these craft were propelled scoured the skins with friction-generated heat like blasts from a blow-torch. The honeycomb materials, which early in 1954 were performing with satisfaction, were by the end of 1954 rapidly becoming obsolescent.

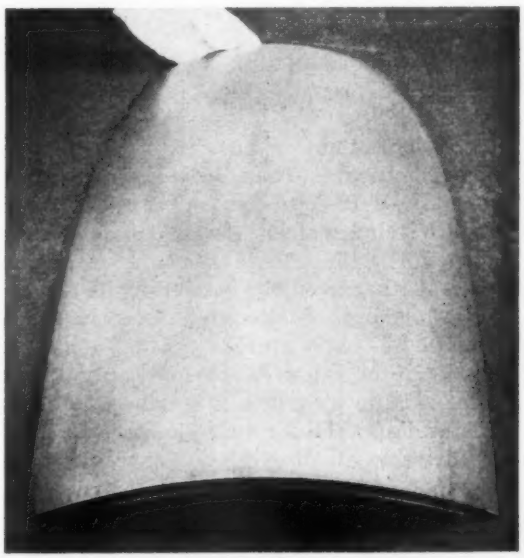
("Obsolescent" is assumed to refer to the suitability of such materials for extreme-condition application in aircraft designed to operate beyond Mach 2.5. Aluminum honeycomb, for example, should still be extremely useful in those aircraft types to operate at lower speeds. —Editors).

A new material had to be found that could bear the full brunt of the "thermal barrier." Actually, this hypothetical line at which the materials of conventional aircraft fail to function varies widely, but 400°F is generally regarded as its lower limit — a temperature generated at flight speed of only 1,500 mph. At 1,900 mph — the speed achieved by the Bell X-2 — temperatures hit a sizzling 600°F, and jump to 800°F as the speed mounts to 2,000 mph.

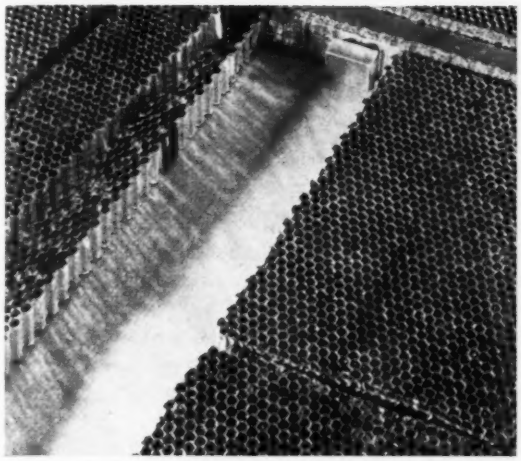
What type of material could meet this requirement for high-temperature resistance — and still satisfy the all-important specification of high strength-to-weight ratio? What high strength-to-weight ratio material would retain its aerodynamic properties in the face of supersonic speeds and the propulsive blasts of the most powerful motors ever used in aircraft? What thin-skinned material could retain its rigidity under the fatigue conditions encountered in flight many times faster than the speed of sound? What metal could consistently "take it" when exposed to the severe corrosion and oxidation of super-heated air and exhaust gases, to the vibrational stresses that shake ordinary honeycomb structures apart?

A made-to-order answer fortunately existed for the aircraft designer: the iron-, nickel-, and chromium-base alloys — the stainless steels. These alloys could be bonded by brazing or welding (as opposed to the use of plastic adhesives in aluminum-honeycombs and in nonmetallic honeycombs) — providing structures that would not pull apart under the conditions of supersonic speed.

However, since the 300 Series stainless steels (which most closely met the design requirements of aircraft structural engineers) obtained strength through cold-rolling, the weld-



The interior of this contoured aircraft panel is a honeycomb structure, made of the new high-temperature-resistant stainless steels.



The honeycomb "core" material, when sandwiched between thin layers of stainless steel, becomes the heart of new all-steel aircraft.

ing and brazing necessary in constructing the honeycombs would produce a softening action, for these operations would be performed at temperatures of stress relieving or actual annealing. To obviate this difficulty, precipitation stainless steels in this series *had* to be developed. The tremendous research facilities of two of the nation's foremost steel producers swung into action, resulting in the three precipitation-hardening stainless steels now enjoying wide application in today's supersonic craft: Armco's 17-7 PH and 17-4 PH, Allegheny Ludlum's AM-350.

It then was up to the rolling mills to cold-roll these materials down to as low as 0.001″, to tolerances as close as ±0.0001″. The availability of these new stainless steels in ultra-thin gauges was a key factor in their incorporation into aircraft honeycomb structures. Why? Simply because the density of stainless is roughly three times the density of aluminum. To replace aluminum and still retain the same overall weight, the steel strip must be about three times as thin as the lighter metal.

However, the companies who had developed these steels were not equipped to reduce them to the ultra-thin gauges required for honeycomb construction. Aircraft procurement officials had to look elsewhere.

They found it in one of the small specialty mills that had pioneered in the rolling of metals of all types to record thinnesses. The amazing technological feat of rolling stainless steels to one-sixth the thickness of the human hair was achieved at the American Silver Company. It solved the aircraft designers' problem of obtaining a high-strength-to-weight ratio with a high-density material. Commercial production of stainless steel honeycomb structures was now feasible — and the way was opened

Recent developments have made it possible to cold-roll the new stainless steels to thickness as low as 0.0005″ and tolerances as close as ±0.0001″. Here, Monroe Sherman of American Silver Co. examines a typical roll.

to the production of new and better multiple-Mach craft.

In this article, the heat treating of 17-7 PH, 17-4 PH, and AM-350 is discussed in some detail. As far as possible, the data presented is applicable when these alloys are used for aircraft honeycomb structures, and also for a variety of other applications. While the major uses of these new steels are to be found in the components of helicopters, guided missiles, jet and other supersonic aircraft (and, more recently, in atomic energy units), they are also being widely, if more prosaically, employed in fishing rods, valve parts, band saws, diaphragms, and police-car antennas.

TYPE 17-7 PH

This steel is, from the viewpoint of the heat-treating technician, a most unusual alloy. It is a member of the chromium-nickel group of

In this cluster mill, 0.468″ work rolls reduce stainless steel strip to thicknesses as low as 0.0005″.

Condition "A" 17-7 PH stainless, shown at 1000X, is annealed at 1950°F (±25°).

stainless steels (i.e., those alloys containing 6.0 to 22.0% Nickel and 16.0 to 26.0% Chromium), the members of which *cannot* be hardened by heat treatment — and yet 17-7 PH can. As a matter of fact, this precipitation-hardening stainless steel was developed precisely to accomplish this. In this way, the tremendous strength needed to produce the high strength-to-weight ratio mandatory for aircraft honeycomb structures is provided.

Other advantages of 17-7 PH are excellent fatigue properties, high modulus of elasticity, and exceptional yield strength. And, when hardened at the proper temperatures, its corrosion resistance (expecially to salt-spray atmospheric conditions and high temperature oxidation) is superior to 400 Series hardenable stainless steels. Because of this, 17-7 PH shows little distortion under heat treatment.

17-7 PH is obtainable from the manufacturer in two conditions: Condition "A" (annealed) or Condition "C" (cold-rolled). In either of these conditions, 17-7 PH can be heat-treated by the fabricator.

Condition "A"

Supplied in sheet, as well as strip, plates, and bars, 17-7 PH in Condition "A" is intended for severe forming operations such as stretch forming or deep drawing, because of its ductility and softness.

Condition "A" is accomplished by heating to 1950°F (±25°) and then air-cooling. This annealing serves the following purposes:

- It removes cold-working stresses.
- It creates maximum softness and ductility.
- It dissolves any chromium carbides that may be present due to:
  a. hot-working
  b. welding
  c. exposure to temperatures in the range of carbide precipitation
  d. slow cooling in that same range of temperatures

During the reduction to the ultra-thin gauges required for aircraft honeycombs, the material will harden and process annealing will be required. The details of this anneal assume front-rank importance not only to the specialty rolling mills engaged in this work, but also to the many fabricators of stainless steel honeycombs who are now equipped with Sendzimir mills and complementary apparatus for their own precision-rolling.

The time required for the anneal is surprisingly short — particularly for thin-gauge material. A rule of thumb offered by the manufacturer would have the parts "soaked" at the temperature of the anneal 3 min for every 1/10th inch of thickness. For ultra-thin sections, "soaking" for as little as 1 min is normal operating procedure.

The process anneal is carried out at the same temperature required for the conversion to Condition "A." This may be readily removed by wet pickling, an immersion of the parts for 1 hr in a solution of 10% NaOH and 3% K_2MnO_4 (percentages by weight) at 160 to 180°F, followed by a 2 to 3 min dip in a bath consisting of 2% HF and 10% HNO_3 at 110 to 140° F.

This scale phenomenon can become more serious if the annealer prolongs the time of "soak," or if he raises the annealing temperature. In those cases, the steel will develop a surface blemish known as "orange peel" during forming or drawing operations. This, however, in no wise indicates an appreciable effect on the characteristics of the steel, since this grain growth does not appreciably alter 17-7 PH's ductility or corrosion resistance.

Although, for members of the chromium-nickel alloy steels, it is generally necessary to cool rapidly after raising to the temperature of the anneal in order to keep the carbides in solution, 17-7 PH is cooled at a somewhat slower rate. Instead of the customary water-quench, the air-quench method is employed to provide a minimum distortion effect.

Some scale will be formed as the heat-treatment is carried on, and the presence of surface oils or other foreign matter will act as adhesives bonding the nascent scale to the strip, increasing by a wide margin the subsequent difficulties of removal. Meticulous cleaning

before each heat-treatment is, therefore, a form of scale-removal in advance.

In Condition "A" the typical tensile strength is 130,000 psi and the yield strength 40,000 psi. These values are raised through further heat-treatment.

Heat Treating Condition "A"

To provide the sought-after high-strength qualities of 17-7 PH, Condition "A" is subjected to a "two-stage" or "double" heat treatment.

First step in securing these higher tensile and yield strength readings is to convert Condition "A" into Condition "T". This is accomplished by heating at 1400°F (±25°) for 1½ hrs. Then, within an hour after the material is removed from the source of heat, it is air-cooled uniformly at a constant temperature of 60°F. Water-cooling may also be used, provided final temperature is reached within an hour. This hour limit is of utmost importance no matter which cooling method is employed, since overreaching it will produce a severe limitation of mechanical properties. This cooling should keep distortions to an allowable minimum, but where further dimensional accuracy is mandatory, reworking in this condition is readily performed.

Transformation into Condition "T" raises the typical tensile strength 15,000 psi to 145,000 psi, and the yield strength by 60,000 psi to 100,000 psi!

To increase the strength still further, the material in Condition "T" may be hardened anywhere within the range of 950 to 1100°F. This second step in the "double" heat-treatment is the active precipitation-hardening process. Material hardened in this manner is designated as Condition "TH XXX," where the XXX stands for the temperature of the heat treatment. For example, Condition "T" material heat-treated at 950°F is designated as Condition "TH 950."

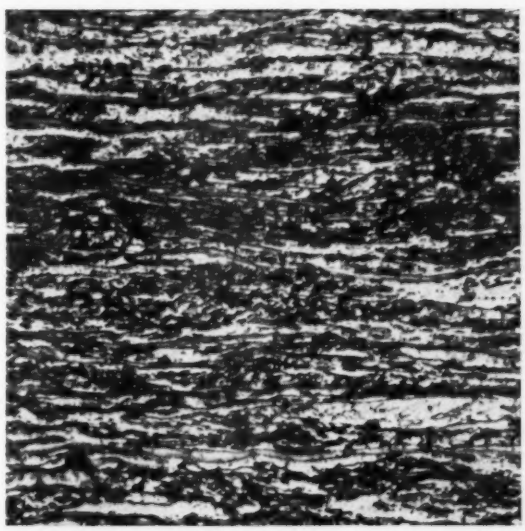
It should be noted that as the temperature rises, the amount of time given the heat-treatment increases. At 950°F, 17-7 PH is treated for ½ hr; at 1050°F, for 1½ hrs. Cooling takes place at room temperature.

The heat treatment markedly increases the strength. Condition "TH 950" shows a typical tensile reading of 215,000 psi, 85,000 psi greater than Condition "A"; and a yield strength of 200,000 psi, 160,000 psi greater than Condition "A"! However, when Condition "TH 1050" is reached, the strengths, although in the same order of magnitude, fall off somewhat: the tensile reading drops 15,000 psi from Condition "TH 950" and the yield strength drops the same amount. This is compensated for by increased ductility, as well as greater corrosive and heat resistance. As a matter of fact, the curve for these latter properties slopes upward as the temperature increases above 950°F. Varying the heat-treat temperature, therefore, creates many variants of 17-7 PH, giving the design engineer a wide range of "different" materials from which to select one which best serves his requirements.

In passage from Condition "T" to "TH" a discoloration called "heat tints" appears, but it has virtually no effect on the properties of the material. While ordinarily no attempt is made to do so, these "heat tints" can be removed with the following pickle: 10% HNO_3 and 2% HF at 110 to 140°F. Any scale resulting from these heat treatments can be easily removed by vigorous brushing with a stainless steel brush providing the material has been meticulously pre-cleaned. Should the scale prove stubborn. vapor blasting is recommended.

Metallurgy of "A", "T", and "TH"

The structure of 17-7 PH in Condition "A" is austenitic with some ferrite. In Condition "T" due to phase transformation occurring under the 1400°F treatment, the structure is changed to an acicular one which bears a resemblance to martensite. It is, however, not fully hardened (some austenite and ferrite remain). Complete hardening is obtained at "TH 950" or "TH 1050." It is characteristic of a precipitation reaction within a solid metal that there is a specific temperature at which maximum hardness is obtained (950°F); below that temperature, hardness decreases due to incomplete precipitation; above that temperature, hardness also falls off, but not as sharply,



Condition "C" 17-7 PH stainless, shown at 1000X, is cold-rolled for tensile strength approaching 300,000 psi.

DATA ON STAINLESS STEELS FOR HONEYCOMB STRUCTURES

	Type AM-350		Type 17-4 PH		Type 17-7 PH			
Analyses — %:								
Chromium	16.00-17.00		15.50-17.50		16.00-18.00			
Nickel	4.00- 5.00		3.00- 5.00		6.50- 7.75			
Other Elements	Mo 2.50- 3.25		Cu 3.00- 5.00		Al 0.75- 1.50			
Carbon	.08- .12		.07 max		.09 max			
Manganese	.50- 1.25		1.00 max		1.00 max			
Silicon	.50 max		1.00 max		1.00 max			
Nitrogen	.07- .13		.....		.....			
Physical Data:			Cond. A	Cond. H900	Cond. A	Cond. TH1850	Cond. RH950 (12)	Cond. CH900
Density—lb /in.³	.286		.280	.282	.282	.276	.276	.277
Specific heat — Btu/deg F/lb (32-212 F)	0.12		0.11	0.11	....	....	....	....
Thermal Conductivity — Btu/ft²/hr/deg F/ft.								
300 F	....		....	124	....	117	....	114
500 F	....		....	135	....	128	....	127
850 F	....		....	156	....	146	....	156
900 F	....		....	157	....	146	....	151
Mean Coefficient of thermal expansion — in /in/ deg F /x 10⁶								
70 — 200 F	6.3 (1)		6.0	6.0	8.5	5.6	6.28	6.1
70 — 400 F	....		6.1	6.1	9.0	6.1	6.66	6.2
70 — 600 F	....		6.3	6.3	9.5	6.3	6.86	6.4
70 — 800 F	7.1 (2)		6.5	6.5	9.6	6.6	....	6.6
Electrical Properties:								
Magnetic permeability								
100 Oersteds	....		74	100	1.4-3.5	80-99	75-87	70.0
200 Oersteds	14 (3)		84	60	1.4-3.2	46-55	44-52	43.5
Maximum	....		95	151	1.4-3.6	134-208	119-135	125
Electrical resistivity — microhm-cm:								
70 F	70.97 (3)		98	77	81.0	85.0	....	83.8
1200 F	83.40 (4)		....	....	....	....	....	....
Mechanical Properties:	Cond. L-1750	Cond. H-1900						
Yield strength — lb/in²	120,000 (5)	75,000 (5)	110,000 (9)	178,000 (9)	40,000 (9)	185,000 (9)	220,000 (9)	260,000 (9)
Ultimate strength — lb/in²	200,000 (5)	180,000 (5)	150,000 (9)	200,000 (9)	130,000 (9)	200,000 (9)	235,000 (9)	265,000 (9)
Elongation — % in 2 inches	8.0 (6)	20.0 (6)	6-15 (9)	12 (9)	35.0 (9)	9.0 (9)	6.0 (9)	2.0 (9)
Reduction in area — %	....	....	30-60 (9)	48 (9)	....	....	....	....
Modulus of elasticity in tension-lb/in² x 10⁶	30.0	30.0	....	28.5	....	29.0	29.0	....
Hardness — Brinnell	....	....	341 (10)	420	....	....	....	....
Hardness — Rockwell	....	C25 (5)	C38 (11)	C44	B85	C43	C48	C47
Impact values — Izod-ft-lb	....	....	....	20	....	....	....	....
	SCT(7)	DA(8)						
Yield strength lb/in²	150,000	135,000						
Ultimate strength — lb/in²	185,000	165,000						
Elongation — % in 2 inches	10.0	8.0						
Hardness — Rockwell	40-45	36-38						
Creep Strength — lb/in²								
1% flow in 10,000 hr (800 F)	91,000							
1% flow in 100,000 hr (800 F)	57,000							
(700 F)	36,000							
(850 F)	22,000							

Notes:
(1) 68 F — 932 F
(2) 70 F — 1750 F
(3) Annealed
(4) 2 hrs at 1375 F, AC, plus 2 hrs at 850 F
(5) Maximum
(6) Minimum
(7) 3 hrs. at 100 F, AC, 3 hrs at 850 F min.
(8) 2 hrs at 1375 F, AC, 2 hrs at 850 min.
(9) Typical values
(10) Flats up to 3" thick; max.
(11) Rounds, squares, and hexagons over 1/8", max.
(12) 10 min at 1750 F, AC, 8 hrs at 100 F, 1 hr at 950 F

and is compensated for by increased ductility and corrosion resistance.

A New Heat Treatment

The manufacturers of 17-7 PH are now recommending a new heat treatment to provide a variant of Condition "A" with tensiles up to 240,000 psi at room temperature. Briefly, this is how this new condition is developed in parts fabricated from Condition "A":

1. Heat at 1750°F (±15°) for 10 min. Air cool.
2. Cool to —100°F and hold for 8 hrs at that temperature.
3. Heat at 950°F (±10°) for 1 hr. Air cool.

The additional strength and hardness developed in the steel by this new treatment is caused by the retention of more carbon in solid solution in the austenite before the change-over to martensite. It is interesting to note that, when this steel is employed in aircraft honeycombs, the brazing operation will further enhance the strength and hardness properties of the strip if it is carried on concurrently with the heat treatment at 1750°F. It is, of course, necessary to select a brazing alloy operative at that temperature.

Because of the newness of this method of heat treatment, detailed shop experience with it is sparse. Experimentally determined values for this condition, known as "RH 950," are included in the tabular matter in this article.

Heat Treating Condition "C"

17-7 PH in (cold-rolled) Condition "C" shows a typical tensile strength of 215,000 psi, as high as that of Condition "TH 950"; i.e. fabricators can obtain strip directly from the manufacturer with tensiles as high as can be obtained by two

heat treatments of annealed material. The typical yield strength of 17-7 PH in Condition "C" is 185,000 psi, equal to the yield strength shown by Condition "TH 1050." Condition "C," however, is highly elastic, and therefore flat-rolled products are not suitable for forming difficult parts.

To provide even greater strength, Condition "C" may be treated at 900°F (±10°) in either air or a reducing atmosphere for 1 hr. Cooling time is 1 hr. The use of a reducing atmosphere prevents the appearance of "heat tints," but since these discolorations do not appreciably affect the physical properties of the metal, either atmosphere can be used with equal effectiveness.

The resultant material, known as Condition "CH 900," provides the structural engineer with the strongest variant of this versatile metal. The typical yield strength is 260,000 psi, the typical tensile is 265,000 psi! What's more, in thin-gauge strip such as is supplied by American Silver Company, tensiles frequently reach 300,000 psi!

TYPE 17-4 PH

Newest of the precipitation hardened steels, this material demonstrates a unit combination of high strength and corrosion-resistant properties. It is supplied by the producer in the form of forging billet, bar and wire forms only. However, one Eastern specialty rolling mill has solved the problem of reducing it to the ultra-thin strip necessary for aircraft honeycomb structures. It may be purchased in the following conditions:

Condition	How Condition Is Developed
1. "A"	Annealed at 1875-1925°F; air-cooled or oil-quenched.
2. "H 1075," "H 1150"	Annealed plus hardened at 1075° or 1150°F for 4 hrs; air-cooled. These conditions used for improved ductility.

Maximum hardening of condition "A" may be accomplished by heating at 875°F followed by air-cooling. Heating is carried on ordinarily from 1 to 4 hrs. This condition is known as "H 875." By similar treatment, condition "H 1000" may be reached. In this condition there is greater ductility and notch impact strength, but there is an appreciable drop in yield and tensile strength and in hardness. It can be seen that a wide range of variations is possible between the temperatures of 875°F and 1200°F. Heat hardening at 1 hr at 900°F (Condition "H 900") is the treatment that meets most demands.

The precipitation hardening element in 17-4 PH is copper, as contrasted with aluminum in 17-7 PH. 17-4 PH is austenitic at this annealing temperature, but transforms to a mertensite-like structure beginning at about 250°F. A similar percentage of austenite and ferrite is retained.

By the incorporation of small percentages of columbium (0.25 — 0.45), the ductility of "A" is improved at the expense of hardness. However, after heat treatment, hardness with or without columbium is the same.

Although 17-4 PH is heat treated by a single treatment, it is frequently advisable to reheat. This is necessary when, in the hardening condition, the material proves strong and hard, but lacks sufficient ductility. In that case, it is recommended that a reheat be carried on at a higher temperature. This increases impact strength as well as elongation. It is important to note that no solution anneal is necessary prior to the final treatment.

Pickling is carried out in much the same manner for 17-4 PH as it is for standard stainless solutions. Only a slight tint is produced on the surface by pickling in HNO_3 mixed with 3% HF (both by volume); at 110 to 140°F this film is removed. The heat tint may also be removed by electro-polishing. Since, however, the pickling method also cleans the surface of iron for maximum corrosion resistance, it is recommended.

TYPE AM-350

This is a new precipitation hardening stainless steel, which can be hardened either by subzero cooling or double aging. As a matter of fact, the subzero cooling method is approved because it produces higher hardness, strength, ductility, impact strength and corrosion resistance. It also prevents excessive distortion and scaling. This is of paramount importance in the fabrication of aircraft honeycombs where extremely close tolerances must be held. (It should be noted that the achievement of minimal distortion and scaling effect is produced as well in the "RH" Condition of 17-7 PH.)

To harden by means of the sub-zero method, the fabricator begins by annealing his strip. He does this as he would any standard grade stainless steel, but he must be careful to hold the temperature between 1700 and 1750°F. This is Condition "L-1750." Air cooling is sufficiently rapid to prevent the precipitation of chromium carbides. In this way, the cooling terminates at room temperature and the mainly austenitic structure which had been formed at the temperature of the anneal is re-

tained. However, once temperature is dropped *below* room temperature, ferrite in a matrix of martensite is obtained and the hardening transformation occurs.

In practice, Condition "L-1750" is converted to a hardened form by freezing at —100°F for at least 2 hrs, preferably three. This is followed by air cooling, then tempering for 1 or 2 hrs. Tempering conducted at 650-750°F produces a superior corrosion-resistant strip; at 850-950°F, ductility is the outstanding characteristic. Only the very slightest discoloration occurs during the tempering, and this is easily removed by dipping the strip into a solution of 15% HNO_3 — 2% HF at about 140°F.

The sub-zero hardening method (specifically, 3 hrs at —100°F, air cooled, plus 3 hrs at 850°F, Condition "SCT") increases yield strength by 30,000 psi over Condition "L-1750," but decreases ultimate strength by 15,000 psi. This decrease in the ultimate strength compares unfavorably with the 17-7's which show marked increases for this value after heat treatment. In a directly comparable case, 17-7 PH's "RH 950" (obtained by sub-zero treatment) *gained* 15,000 psi. A loss of ultimate strength in the same order of magnitude occurs when AM 350 is hardened by double aging.

To harden by double aging, the first step is again the anneal. This is Condition "H-1900." In the first stage of the heat treatment subsequent to the anneal, time and temperatures are selected to result in the precipitation of chromium carbides, altering the austenite so that, at room temperatures, transformation to martensite occurs. This stage (known as "the intermediate aging treatment") is accomplished by heating for 2 hrs at 1375°F and air cooling to room temperature. The second stage — 2 hrs at 850°F — produces a mixture of chromium carbides around the ferrite islands and at austenite grain boundaries within a matrix of martensite; hardness and strength have been increased. This is Condition "DA" and it shows an increase of 60,000 psi over the yield strength of Condition "H-1900," but a decrease in ultimate strength of 15,000 psi. Condition "DA" is weaker than Condition "SCT."

With double aging, moreover, the scale problem recurs. To minimize the scale, precleaning is recommended. Scale removal is simplified by pickling, according to standard procedures for any austenitic steel, before heating at 1375°F.

Summary

Aircraft designed to break the thermal barrier must be composed of metal resistant to the extremely high temperatures and the unparalleled stresses of supersonic flight. New *heat-hardenable* steels in the 300 series were developed to meet these requirements. Their use was made possible by the concommitant developments of honeycomb structural design and the techniques for rolling steel to thicknesses many times thinner than a human hair. New heat treating methods, including sub-zero treatments, produce the exceptional strength of these steels.

end

Credits

The organizations which have made major contributions to the research for this article are:

Air Research & Development Comman, USAF.
Allegheny Ludlum Steel Corporation.
American Silver Company, Inc.
Armco Steel Corporation
Fairchild Electrotechnics, Division of Fairchild Engine & Airplane Corporation.
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MULTIPLE PUNCH CONSTRUCTION FOR A SHORT RUN DIE

by Joe Harner
Nevada, Missouri

A Step-by-Step Description of the Procedure for Constructing a Relatively Inexpensive Die

THERE ARE INNUMERABLE DIES built annually in this country that can be termed "short run dies," because the parts to be produced are usually limited in number. This number may vary from a few hundred pieces to a million.

The work produced is not inferior in any way; blanks or punchings from such dies should not show any differences from those produced on the most expensive progressive dies. These dies are hand fed, and a high rate of production is not expected from them; however, with a good demand built up for the part, such dies may be in use for years. Consequently the die steel must be of the best, the cutting edges carefully fitted, shearing angles left where required, and proper clearances allowed.

No die sets are used, but two setting blocks are made to simplify setting and to keep the die in alignment when not in use. This also holds down the die cost.

In building these dies good mechanical skill is a necessity, but a die maker's experience is not essential. Design details should be complete. The designer should *understand,* but not necessarily know how to use, each machine tool in the die shop. He should also understand the die steels, characteristics of the work material, and heat treating. He should know all the pertinent details of each press in the plant or in the department. He must consider the safety of the press operator — how is the press now guarded? Will the die work satisfactorily with the present guard? Can a safety feature be built into the die?

The die we shall discuss was designed for a straight sided 70-ton press with a 1½" throw in which the blanks were fed from the front. The design details for the die were complete and,

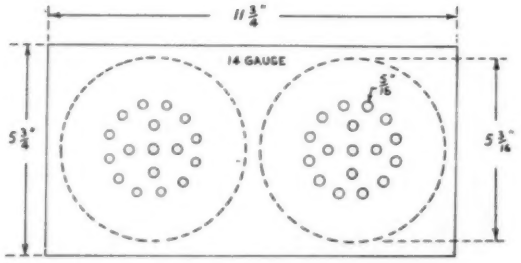


Fig. 1. Stock Unit.

with close supervision, a very good die was made.

The job called for round blanks $5\frac{3}{16}$" cut from 14-gauge mild steel stock, each blank having 17 holes of $\frac{5}{16}$" dia arranged in a circular pattern. This setup would have been ideal for a progressive die; however, there was no justification for such expense since the part was on a new product that might or might not find a wide market. So two dies were decided on — one to punch the 17 holes and the other to blank out the disc. For ease in handling, it was decided to cut the stock 12" long so that two discs could be cut from each piece — one from each end. This would allow for rapid handling and have a built-in maximum of safety inasmuch as the operator's hands need never come close to the danger zone.

The stock unit in Figure 1 shows both ends perforated. The dotted outline indicates where the next die will blank the discs.

The die assembly, Figure 2, for perforating consists of a tool steel die and die shoe, a stock support assembly "A," stripper plate and blocks, punch holder with punches, and a back-up block.

The following steps detail how the die assembly is made:

Die Shoe and Back-Up Block

The die shoe and punch back-up block are cut from mild steel plate with a torch. If the operator knows his business and has the correct tip, the cut will not be objectionably rough. Burred edges can be ground smooth, and the die shoe put on a planer and faced on both sides. If the edges are rough from poor cutting, they should also be faced at the same time. The back-up block is ground, then chucked in a lathe, and faced on both sides to size. A lathe will be found much faster for this work than a shaper.

Punches

All 17 of the $\frac{5}{16}$" punches, plus two extra, are made from $\frac{1}{2}$" drill rod, using a collet chucked in a lathe. Figure 3 shows one of these punches. Care should be taken to see that all $\frac{5}{16}$" punch ends are of the same size with no sharp angles at "E" (a tool scratch here can cause punch failure). The groove at the top, "F," is made so Cerromatrix metal holding the punches can get a grip on them, thus preventing any punch from being pulled down through the punch block as the stock unit is being stripped off. The force required to strip a unit from a punch can be almost as

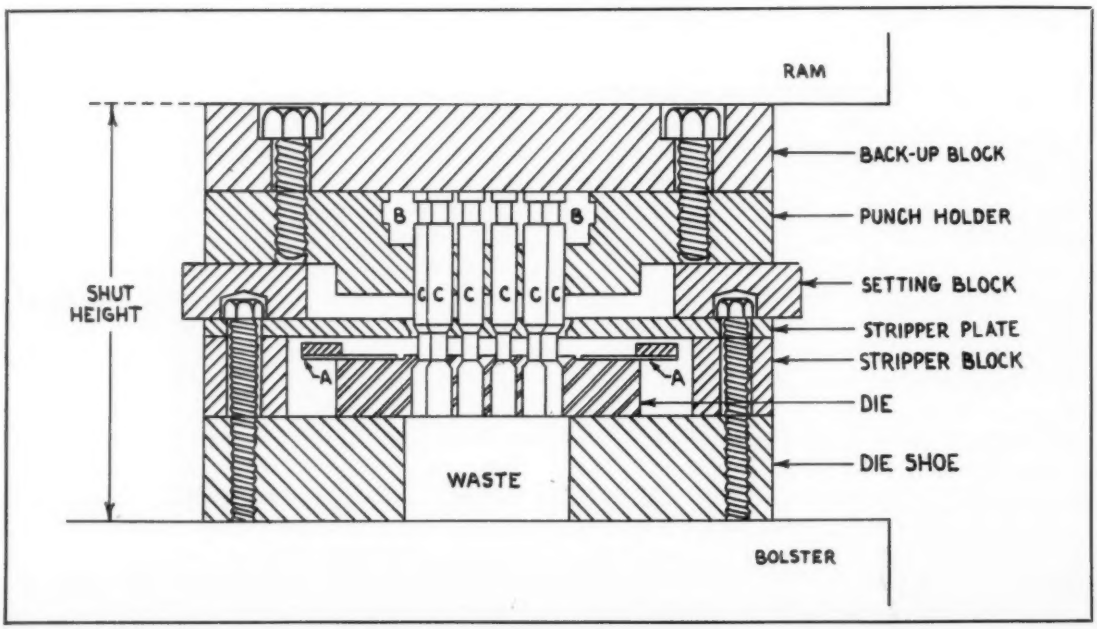


Fig. 2. Cross-Section, Front Elevation.

much as that necessary to punch the hole, if punches are not kept properly lubricated.

The punches are heated in a hardening furnace to 1400°F, quenched in salt water, drawn to 400°F, then polished with emery cloth and oiled.

Punch Holder

The punch holder is made from mild steel. A cavity, Figures 2 and 4 "B," is turned into the top and includes a groove "H" to secure the Cerromatrix metal. The center "I" of the cavity is carefully center punched, the bottom blued, the 17 punch holes laid out with a pair of light dividers, and each center punched.

Die

The die is cut from high grade, non-deforming, oil-hardening tool steel and faced on both sides to size.

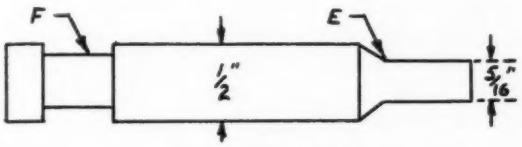


Fig. 3. Punch, Full-Size.

Stock Support Assembly

This assembly, Figure 5, is made from mild steel and is used to position the workpiece. It includes the stock support, stock support block, stock guides, and stock stop.

Stripper Plate and Blocks

The stripper plate is cut from 3/8" mild steel, and both sides faced on a lathe. The stripper blocks are made from mild steel and are used to position the stripper plate above the die.

Machining and Fitting Procedure

The punch holder, die, and stripper plate are centered and tack welded together. Each piece is alignment punched on the front so that correct re-assembly can be made after the welds are removed.

This welded assembly is taken to a table type drill press that has been braced to prevent any possibility of deflection. A new 1/8" drill is used to drill each of the center punched marks 1/2" deep in the punch holder cavity. Each 1/8" hole is re-drilled without undue pressure with a new 1/4" drill through the assembly. The tack welds are ground out, and the pieces separated.

The punch holder is drilled with a new 5/16" drill, then with a 3/8" drill, stepping up the drill size by 1/16" until a new 1/2" drill finishes the

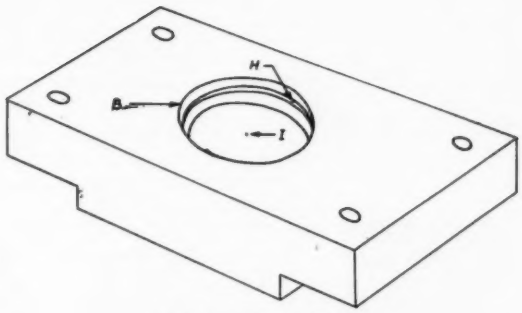


Fig. 4. Punch Holder.

17 holes. A reamer is used until the punches just slide into place without clearance (Class 4 — Snug fit).

The punch holes in the die are drilled through with a 5/16" drill from the top, turned over, and a 1/2" drill run in to within 3/16" of the top. The offsets, Figure 6, for the stock support are cut in the top of the die on a shaper. The 4 bolt holes are drilled and tapped for 1/2" bolts.

The 17 holes in the stripper plate are re-drilled through with an 11/32" drill. From the top (make sure it is the top) a 5/8" drill is run down to within 1/8" of the bottom. This 5/8" space accommodates the 1/2" body of the punch.

All required bolt holes are drilled in the die shoe, and the waste hole bored; the four holes for the 1/2" bolts that hold the die are countersunk from the lower side.

Secure the die to the die shoe. Two taper pin holes are drilled and reamed, and the pins fitted. Remove the die so that it can be fitted and then hardened.

Fitting the die to the punches is done by placing the die on a surface plate, Figure 6. Seventeen 5/16" pins are cut from cold rolled steel, the length being 1/8" less than the die thickness. One pin is dropped into each die punch hole. Positioning blocks should be of a height that will allow the punches to project about 1/64" above the punch holder. The punch holder is then centered over the die on the positioning blocks and a punch "C" slipped into

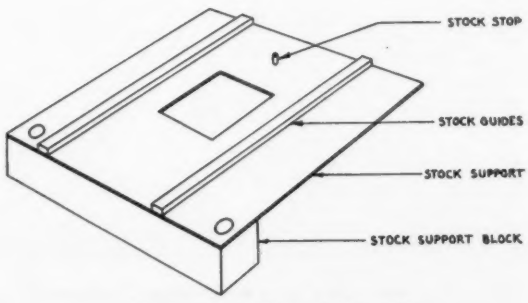


Fig. 5. Stock Support Assembly.

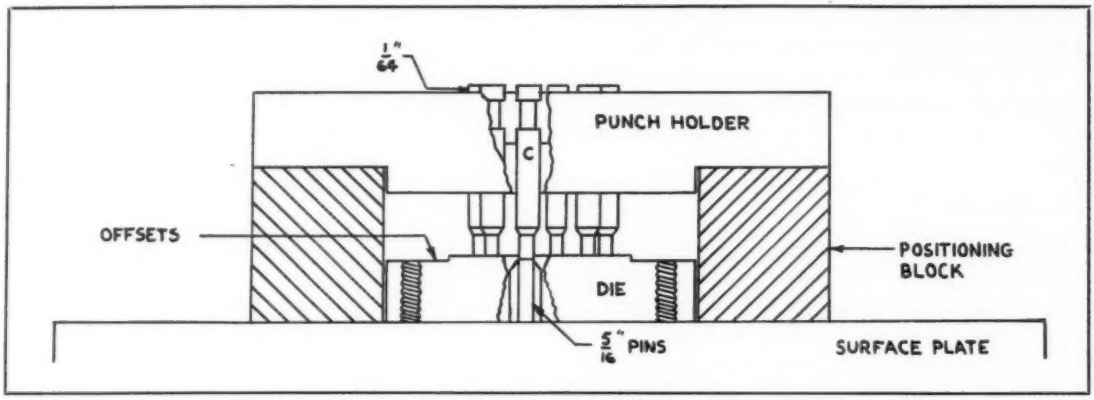


Fig. 6. Setup for Aligning and Securing Punches in Punch Holder, Using Cerromatrix.

each hole and into the die block below until they rest on top of the pins. This allows the punches to go 1/8" into the die. Care must be taken to see that each one enters full length.

The punch holder is now heated to around 250°F by a blow torch. While this is being done, a ladle of Cerromatrix metal is melted and skimmed. The metal is puddled around the punches in the cavity Figure 2 "B" until it completely encloses each punch. The torch is turned off, and the holder allowed to cool.

The holder assembly is taken off the die, and the projecting tops of the punches are ground even with the top of the holder.

All 5/16" punch holes in the die are then reamed .004" oversize to provide cutting clearance for punching 14-ga metal.

The die is placed in a hardening furnace and brought up to 1440°F. The heated die is dropped face down into 120°F tempering oil, and after cooling is drawn for two hours at 375°F. Shrinkage is such that the punches will fit the die without trouble.

The die (4 bolts), the stock support assembly (2 bolts) and the stripper plate and blocks (6 bolts) are secured to the die shoe in that order.

Setting blocks are drilled to go over the 6 bolt heads, 3 each side, holding the stripper plate.

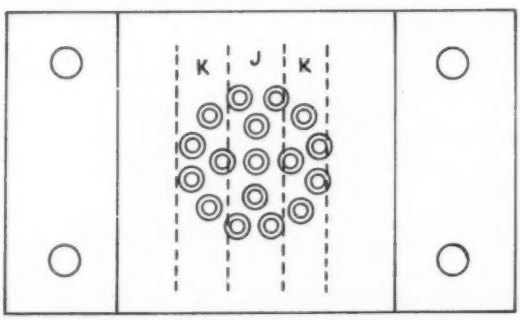


Fig. 7. Lower Side of Punch Holder, Indicating Punches K-K to be Ground Down for Shear.

The punch holder and punches are mounted on a grinder with the punches up, so that shear can be ground to reduce the punching pressure. Figure 7 shows the upturned punch holder. All punches in space "J" remain unground, all punches in spaces "K-K" are ground down 3/64". This should reduce the punching pressure by half.

The back-up block is bolted to the top of the punch holder, the setting blocks, Figure 2, put in place, and the punch assembly carefully lowered into the die.

The die assembly is then positioned in the press. The ram is lowered until it just clears the back-up block, the ram bolts screwed in place, the ram lowered to the correct height on the setting blocks, the die shoe bolts put in place and secured to the press bolster, all bolts secured, the ram raised, the setting blocks laid aside, and the press turned over once. For testing purposes a 20-ga unit is punched. If there are no burrs on any hole, it is followed by a 14-ga unit. (Four hundred blanks were run through at the rate of 300/hr as our final check.)

This was the first die our machinist ever made, and the time required was 48 hrs. Materials used were 125 lbs of mild steel, 10 lbs of tool steel, two 1/2" drill rods 3' long, necessary bolts, and Cerromatrix metal.

The description given for making this die can be used as a basis for making dies having any number of punches. In our case the machinist was new to the work and supervision required more time, but we found it was worth it. No dimensions are shown on the drawings, but all necessary details such as the kind of tool steel to use, and the tempering heats and procedures are included.

In its "short run" capacity this die represents about as simple a die that can be made. When high production dies are made, precision die sets should be used. end

PROCEDURES FOR BRAZING

by Torch, Gas-Air Burner, and Salt Bath

by Lester F. Spencer
Consultant
West Allis, Wisconsin

THE METHOD OF HEATING to be chosen for a particular brazed joint is frequently quite a problem. One must consider not only the production of a sound joint, but also the economy of the heating method. In many instances, the method of handling the component parts in semi-automatic or automatic installations is also involved.

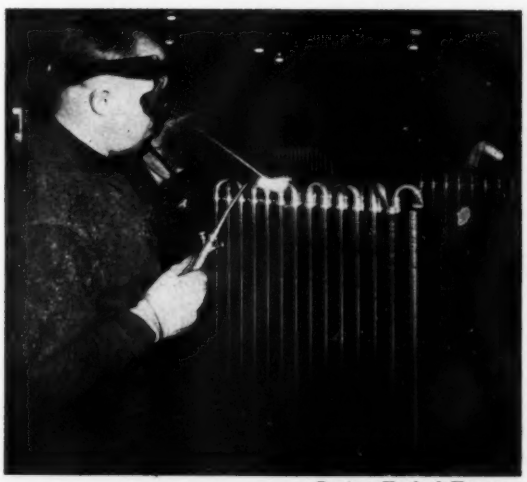
On parts that have to be clamped together during brazing, resistance heating methods where the electrodes can perform the clamping operation may be the preferred method. Relatively large parts in high production may prove quite expensive when brazed by an induction method, whereas a more economical production may be realized when a furnace or salt bath brazing technique is employed. The use of double tip torches has made the brazing of some piping and tubing faster, more efficient, and of higher quality. Thus, skill, ingenuity, and experience are so important in developing and evolving methods to fit the conditions of the job.

One advantage realized in both silver brazing operations and the brazing of the light metals, viz., aluminum and magnesium, is the relatively low melting and flow points of the alloys involved which will permit a low heat requirement. In addition, a variety of heating methods is available to obtain the brazed joint; the heating methods to be considered in detail in this and later articles will include the gas torch, the gas-air burners, induction heating, salt bath dipping, furnace brazing, and both electric resistance and incandescent carbon brazing.

Torch Brazing

This method of brazing, using one of the oldest and most widely used methods of heating, is quite versatile and adaptable to almost any brazing job. An outstanding characteristic is its simplicity in operation, and as a result torch brazing is used to a considerable extent in the shop for a variety of low production jobs and for general purpose brazing. Since the brazing operation is manual, as illustrated in Figure 1, it will have a high labor cost and the skill and the judgement of the operator will determine the quality of the work.

Various types of gas torches are available; standard torches, hose and regulators are suitable for average shop work. Fuel combinations used commercially include oxy-acetylene, oxy-hydrogen, oxy-natural gas, acetylene-air, and gas-air. While all of these fuel combinations are satisfactory for many applications, the oxy-acetylene combination offers the hottest flame, heats fastest, and is the most flexible. The torch type and the gas combination to be employed would hinge on several factors

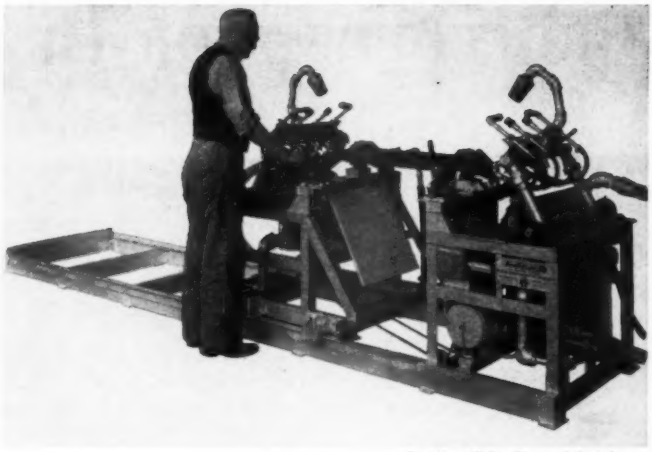


Courtesy, Handy & Harman

Fig. 1. A high percentage of refrigerator parts are brazed with torch and hand-fed brazing alloy.

Courtesy, Selas Corp. of America

Fig. 2. An unusual brazing application involving cast iron headers, copper tubing, and aluminum fins.



Courtesy, Selas Corp. of America

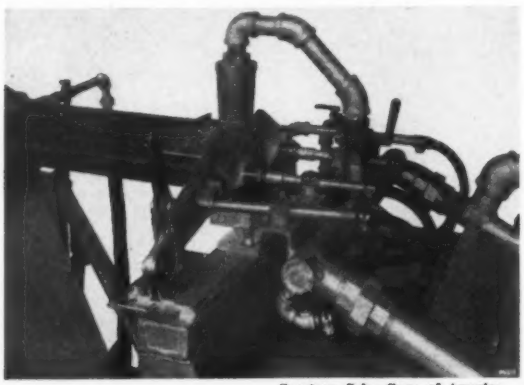
Fig. 3. Specially designed equipment for the brazing of convector-type room heaters.

including production requirements, mass of the parts to be joined, thickness of the joint area, and accessibility of the joint. In any event, preliminary trial tests may be required to obtain the most efficient combination.

A neutral flame is preferred; the flame being sufficiently bright to harm unprotected eyes, therefore necessitating the use of goggles. They also provide protection against flux spatter. The torch tip should be clean and free from flux; the joint area painted with the flux paste; and, the torch moved continually over the joint area until the joint members are at the brazing temperature. The filler is now hand fed into the joint and will melt when it contacts the heated parts. Capillary action will carry it into the joint with alloy flow being in the direction of the hottest area. Continual movement of the torch over the work is especially important in the brazing of thin parts, because they are very easily overheated. If pre-placed alloy is used, it is essential that the alloy not be melted with direct impingement of the flame. It is considered better practice to allow the alloy to melt as the joint itself reaches the brazing temperature. Another precaution to observe is to control heat input; a flame that is too hot may melt whole sections of filler, making it difficult for capillary action to draw it into the joint.

Relatively complex assemblies, such as the refrigerator coils, Figure 1, are well adapted for torch brazing since each joint is made individually. To produce a satisfactory joint in a tube, it is useful to flare one of the workpieces so that the other piece will fit inside. The usual application of flux is required, with the fit between the pieces to be joined permitting the escape of any gas that may be generated during the brazing operation.

The final joint should have a smooth fillet that will require little or no finishing. All of the flux remaining after brazing should be removed after the alloy has cooled sufficiently to set. When both sides of a brazed joint are accessible, as would be the case in the brazing of a spout on a copper perculator body, a fiber brush in a boiling hot water bath will remove most of the flux. If the assembly is large, flux removal can be accomplished either by dipping in hot water, spraying or washing off with a wet swab. Where a thoroughly clean appearance is wanted, the work can be wire brushed, cleaned with emery cloth, or pickled in a suitable solution.



Courtesy, Selas Corp. of America

Fig. 4. Close-up of the burner arrangement for brazing the convector-type room heater.

Gas-Air Burners

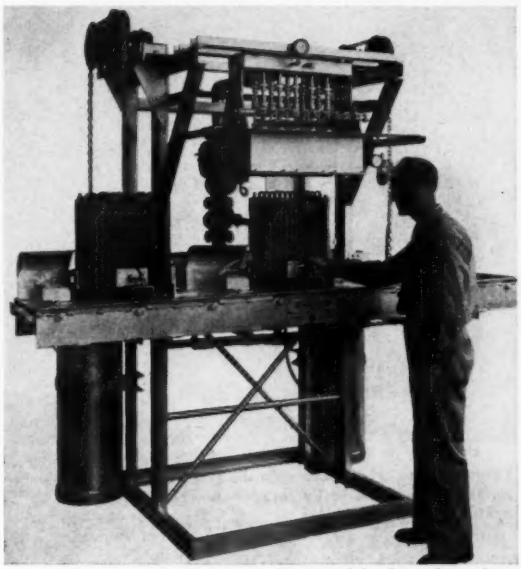
This method of brazing is relatively rapid and permits the heat to be localized. It is quite flexible in that a combination of fixed burners can be planned for the brazing of assemblies

of regular or irregular contour, both large and small. In addition, this method is suitable for high production when used in conjunction with mechanical devices for quick handling of parts and automatic control of the heating cycle.

In practice, heat is delivered by one or more refractory type gas-air burners while the work assemblies are held in an appropriate fixture. Automatic fuel carburetion by means of a gas combustion controller develops constant heat-release rates at the burners; the time of exposure to the high temperature gases is also controlled closely to obtain duplication of the heat cycle, piece after piece. Pre-fluxing and pre-placement of brazing alloy will assure ample filler metal in every joint without waste. The mechanical control of process variables, such as heat placement, heating time, etc., permits the use of unskilled labor in producing quality work.

An excellent example of the close control of process variables is the brazing of a convector-type room heater, Figure 2. In this example, copper tubes having aluminum fins are brazed to cast iron end pieces. Thus, heavy iron header and thin tubing must be brought to the brazing temperature; and, at the same time, the temperature must be controlled, since overheating by only 50°F will cause the aluminum fins to melt. The equipment which produces the brazed convector is illustrated in Figure 3; the semi-automatic installation brazes an iron header at each end of the convector by 4 small burners, while the tubes are heated internally by a large burner at each end which directs the flame into the large port in the iron casting. Once the work has been set in place, pushbutton control lowers the burners in position and turns them up to high fire for a 2½ min brazing cycle. Burner arrangement is illustrated in Figure 4; the burners can be adjusted to accommodate 2, 3, 4 or 5 tube assemblies. The support fixtures can be adjusted to accommodate any overall length from 18 to 72″.

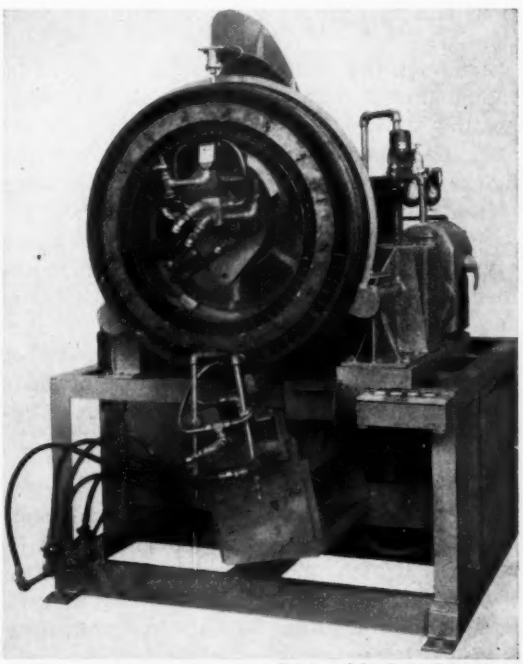
In the brazing of evaporator assemblies of a room air conditioner, Figure 5, an oscillating carriage brings the evaporator assembly under the burners for the simultaneous brazing of 26 joints. The operator preplaces silver brazing alloy rings, flux, and copper return-bends in the ends of the copper tubes. The operator unloads and loads one station while the other station is in the heating position. As in the previous example, close temperature control is essential to prevent damage to the aluminum fins. In addition, the support table as well as the burners are adjustable to accommodate workpieces of varied size and shape.



Courtesy, Selas Corp. of America

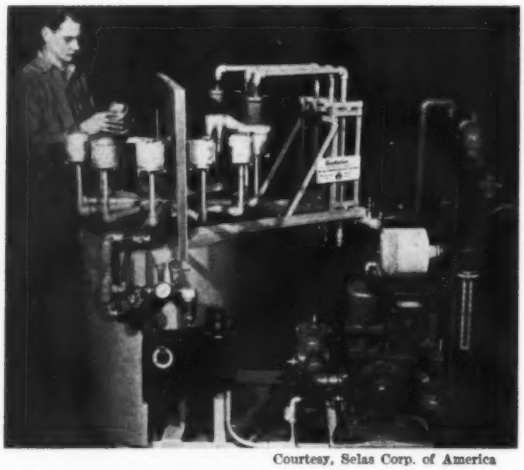
Fig. 5. Semi-automatic equipment used to braze 26 joints of evaporator assembly.

In the unique arrangement shown in Figure 6, 58 hollow stainless steel blades are silver brazed to inner and outer shroud rings for a jet turbine compressor assembly. Each blade is pre-fluxed and pre-placed with a suitable brazing alloy and then clamped into position. The entire assembly is rigidly clamped in a heavy water-cooled fixture to maintain concentricity and flatness; the entire unit rotating



Courtesy, Selas Corp. of America

Fig. 6. Individual brazing of 58 hollow stainless steel blades to inner and outer shroud rings of a jet turbine compressor assembly.



Courtesy, Selas Corp. of America

Fig. 7. An aluminum sheathed electric heating element is automatically brazed to the bottom of a kitchen appliance.

in a vertical plane to permit the brazing of each individual blade.

Figure 7 illustrates an automatic setup in which an aluminum sheathed electric heating element is automatically brazed to the bottom of a drawn aluminum shell. Pre-cut and shaped brazing alloy wire along with the heating element are placed on the upturned bottom of the aluminum cup. The operator assembles, loads, and unloads to realize a production rate of approximately 180 units/hr. The conveyor moves forward one station at a time to carry the assembly from the load-unload position through the various heating and cooling stations and finally back to the load-unload position.

Although the basic heating time remains in the neighborhood of 75 sec, the use of several heating stations operating simultaneously allows the development of adequate preheat before the assembly enters the final brazing station. The cooling stations provided will assure the solidification of the brazing alloy and also the cooling of the assembly to permit unloading. Characteristic of much semi-automatic and automatic equipment, the entire production can be obtained from a single piece of equipment on a minimum amount of floor space; in this specific example, floor space required was but 6 sq ft.

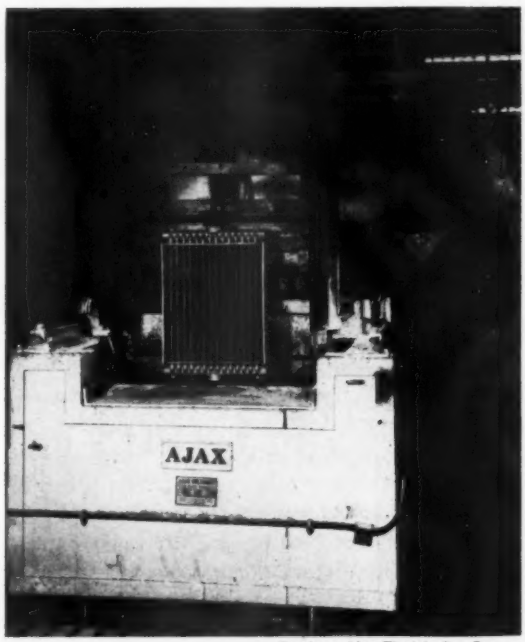
Dip Bath Brazing

Dip heating can be performed either by immersing the joint in a molten alloy or in a molten salt bath. The *metal* bath is suited to the brazing of small joints that may be conveniently dipped into the bath by hand. The joining of twisted wire joints is frequently done by this method. A crucible type furnace is employed, and this is heated either by gas, oil, or electricity. The joint is fluxed and dipped into the molten brazing alloy. When the joint has reached brazing temperature, alloy from the molten bath flows into the joint capillary to produce the braze.

The *molten salt* bath is of more practical importance in the brazing of small to medium sized assemblies, and is widely used in industry. The method consists of assembling the part with pre-placed alloy in position and then immersing the assembly into the molten salt. As soon as the immersed joint has reached the brazing temperature, which usually is a matter of seconds, it is removed from the bath. The brazed joint solidifies upon contact with the atmosphere or upon quenching, and any residual sale adhering to the assembly can be quickly dissolved by immersing in hot water.

A number of advantages realized by salt bath brazing include: — (a) accurate temperature control within 5°F realized by the electrodynamic stirring action produced by the magnetic forces at the electrodes*; (b) minimum of distortion due to the relative uniform heating that is obtained; (c) heating estimated to be from four to six times more rapid than that experienced with radiation type furnaces; (d) ability to braze a large number of assemblies by either batch or continuous procedure; (e) elimination of controlled atmospheres and cooling chambers which characterize furnace brazing; (f) due to the complete immersion of the assembly, scaling or decarburization is

*This temperature variation does not alter with salt bath size.



Courtesy, Ajax Electric Co., Inc.

Fig. 8. Salt brazing 44 copper tubes to a radiator manifold in a single operation.

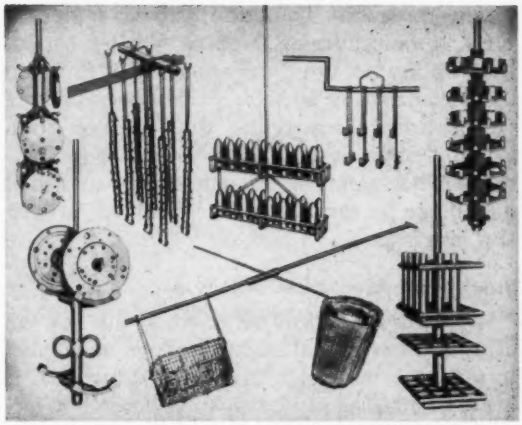
eliminated; and, (g) in the production of ferrous brazed assemblies, operations such as carburizing or hardening can be conducted simultaneously with the brazing operation by selecting the proper salt type.

Like any other procedure, salt brazing has limitations which tend to make it unsuitable for certain applications. These limitations would be:

1. The economy attached to salt bath brazing depends primarily upon the production requirements; the highest economy being realized when the salt bath is used on a continuous basis. Thus, when the bath is not in use, it must be kept either in a molten condition or shut down and then remelted later when required. This latter condition will involve considerable power expense. But, in some cases, other factors will justify intermittent operation.
2. It is difficult to braze assemblies that are buoyant in nature. This frequently may be eliminated by proper design changes.
3. Difficulty may be experienced in the brazing of blind joints where the removal of molten salt is hindered. This condition also may be eliminated by proper change of design.
4. It should be realized that there are temperature limitations in salt bath brazing. Thus, the salt bath selected may work perfectly for silver brazing technique; however, if either copper or brass brazing is to be performed, another salt having the appropriate melting range must be used. This necessitates drainage of one type of salt from the bath to replace another type.

Courtesy, Ajax Electric Co., Inc.

Fig. 9. Simultaneous brazing and carburizing automotive starter shaft and gear assemblies.



Courtesy, Ajax Electric Co., Inc.

Fig. 10. Suggested brazing fixture designs.

The economies of salt bath brazing can be well illustrated by the silver brazing of 44 copper tubes to a radiator manifold (Fig. 8) in a single operation that required less than 6 min. This is an example of partial immersion in salt. Another example is the silver brazing of a copper heat exchanger; the brazing metal was the self fluxing silver-copper-phosphorous alloy, the brazing temperature was 1500°F, and the time for brazing was 1¼ min as compared to a formerly used torch brazing procedure that required 30 min.

The simultaneous brazing and carburizing of automotive starter and gear assemblies is shown in Figure 9. The material is a low alloy steel, the brazing alloy is brass containing 60% copper and 40% zinc, the salt bath material is an active cyanide, and the brazing temperature is at 1675°F. The assemblies with pre-placed brazing alloy are immersed into the salt bath; however, even though brazing is completed in a matter of a few minutes, the load remains in the activated cyanide bath for 45 min to produce a case of 0.018". The final step in the cycle is quenching to obtain a hard, wear resistant surface.

This application raises an interesting point in the use of salt brazing for the joining of steel components with either copper or brass. In furnace brazing, the use of copper filler metal is preferred over brass due to the tendency for the zinc component in the brass alloy to volitalize. However, in salt bath brazing it is practical to substitute brass for copper as the brazing material and develop joints of adequate strength for most steel assemblies. The speed of salt bath heating plus the absence of all atmosphere in contact with the work, avoids the danger of dezincifying the brass during the

brazing process. Thus, the brazing temperature can be reduced from 2050°F when copper braze alloy is used, to about 1700°F when brass braze alloy is used. This lower brazing temperature subjects the steel to less grain growth, distortion, and objectionable surface disturbances and, at the same time, makes it possible to perform the dual role of carburizing and brazing.

Brazing of Aluminum Alloys

Brief attention will be given to the brazing of aluminum and aluminum alloys as related to salt bath brazing. This class of material is brazed quite readily by this method. The aircraft heater, composed of 58 separate aluminum parts, is completely brazed in 15 min. A previously used hand torch brazing procedure required a full day for completion. However, there are certain peculiarities in the brazing of aluminum alloys which should be carefully observed, the more important of which are:

1. Due to the relative small difference in the melting points of the brazing alloy and the material to be brazed, the temperature of the brazing bath should be held to very close limits. In some instances, in order to reduce the time factor in the brazing bath, it may be well to pre-heat the assembly, it may be well to pre-heat the assembly, usually between 900° and 1000°F, before immersion in the bath.
2. Bath contamination is of greater magnitude in salt brazing aluminum alloys than that experienced with any other material types. If supporting fixtures are to be used for aluminum assemblies, it is preferable that the fixture not contact the molten bath. If this cannot be avoided, the fixture material should be nickel, monel or aluminum so as to prevent iron contamination of the bath.
3. Rectification of the bath is usually essential when brazing aluminum base alloys. Objectionable metallic impurities will produce a discoloration on the assembly, whereas moisture within the bath can be detected by small orange colored jets of burning hydrogen above the bath.

Properly designed fixtures, using the minimum weight of material and permitting the most compact assembly of the work, have an important bearing on the size of the furnace required for a given production rate. In addition, fixture design will have an important bearing on power consumption of the furnace and on the life of the fixtures themselves. Figure 10 shows a few typical examples of fixtures that can be used for a number of salt bath operations including brazing. end

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AUTOMATIC PRECISION CRANKPIN GRINDING MACHINE ANNOUNCED

Crankpin surfaces on four-pin automotive crankshafts are precision ground on a new high production, completely automatic, transfer type machine.

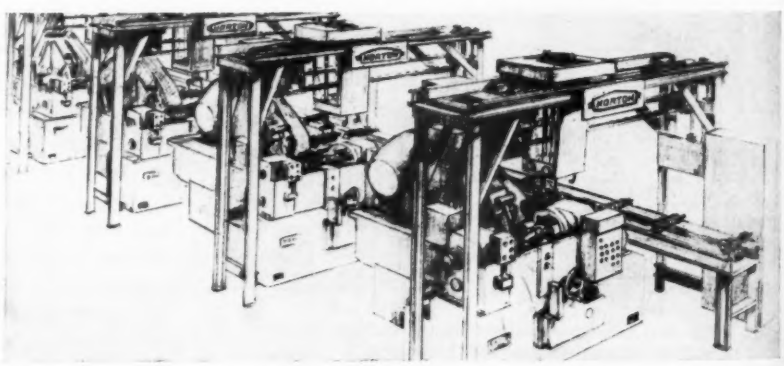
The Norton Company's No. 2 Unitized Transfer Type Automatic Crankpin Grinding Machine is designed to finish grind 240 pins/hr without manual effort on the part of the operator and will produce a substantial saving in cost over conventional methods.

The machine consists of four separate, self-contained, easily regulated units. Each unit independently grinds a single pin on the crankshaft. Because of this feature, any unit may be cut out of service without affecting the operation of the other units or transfer equipment. The units are installed in a row, and are connected only by means of a conveyor which carries the cranks between units.

Faster work loading and unloading is possible because of a double hook mechanism. An unground crankshaft is placed in the work holders when the ground crankshaft is removed. The mechanism automatically locates the work in correct position for grinding both angularly and longitudinally.

All transferring operations are done during the grinding cycle.

Other features of this machine are automatic wheel truing coupled with automatic wheel wear compensation, constant peripheral wheel speed, balanced torque work spindle drive, and a complete system of safety interlocks to shut down the machine in case of malfunctioning.



Fixture for Gaging OD of Segment-Shaped Components

by W. H. Halliday
Southport, England

CONSIDERABLE DIFFICULTY has been experienced with the inspection of quantities of large segment-shaped components of the kind shown at (X) in the drawing. These parts were formed by conventional roll-bending of rectangular section, bright steel bar, 3/8" thick by 3 3/4" wide. They had to be produced with an accurate circular curvature, and certain numbers were required in 4 different OD's.

The largest size segments were to be 21.937" OD and the smallest size parts were 16.625" OD. The respective diameters had to be held to tolerances of ±.003" in every given size. This, because each segment had later to be fitted snugly within a bored circular recess in a housing for retaining the complete assembly unit.

Each finished segment had to be gaged to check for adherence to such tolerances; and also to give the machinist the exact diameter dimension of the recess to be bored for housing each particular segment.

Conventional measuring instruments and the usual type of gages could not be applied to parts of this "difficult" shape. To overcome this problem a gaging fixture of the type illustrated was designed and most successfully applied to this job. Its use enabled the OD's of all 4 sizes of segments required to be gaged with close accuracy, great simplicity and rapidly.

Referring to the diagrams, the fixture comprises the long rectangular case-hardened steel base (A) which is of substantial stiffness. Hold-down screw holes (B) are provided, one near each end, to secure the complete fixture to a stand or bench. The top surface (C) is ground perfectly flat and parallel with the plain-milled underside of the member.

A hardened and ground rectangular steel block (D) is press-fitted into a shallow slot machined transversely across surface (C) near the right-hand end of the base. The block is permanently retained by cap-screws (E). It is fitted so as to project exactly 1.00" above surface (C) and stand perfectly perpendicular to that surface. The edges along the top side of the block are left sharp as shown. The length of the block is about 3/4" greater than the width of the base (A).

The hardened and ground steel slider piece (F) — of L-shape — is tongued on its underside to fit closely yet slide smoothly within the wide shallow parallel-sided guideway (G) cut into the top of the base approximately central in the width of the latter. The highest portion of the member (F) stands exactly 1.00" above surface (C) to correspond with the similar projection of the fixed block (D). The right-hand side of this portion of the slider lies perfectly parallel with the adjacent inner side of the stationary block (D). This same part of the slider is made the same length as block (D) so as to overhang a similar distance beyond the front long side of the base (A).

A narrow elongated slot (U) is machined wholly through the base to be central with the guideway (G) and extending about the same length. This second slot is wide enough to admit easily the shank of bolt (I), whose square head is passed into the wider slot (J) milled along the underside of the base. The width of the latter slot is slightly greater than the across-flat dimension of the bolt head so that the latter may slide freely but is unable to rotate. The shank of the bolt passes through a clearance hole drilled through the stepped portion of slider (F). The latter is locked in any desired longitudinal setting along the base by means of the knurled thumb-nut (K) threaded on the bolt. The length of guideway slot (G) is determined so as to allow the slider to be moved a sufficient distance to suit all 4 diameters of segments (X) to be gaged.

The portions of block (D) and slider (F) which project beyond the front side of the base as at (L) and (M) respectively, are stepped to be exactly 0.250" thick in each case. The outside edges (P) and (Q) on such steps are carefully lapped flat; and to be perfectly parallel with each other at all points, as well as lying perpendicular to the ground surface (C). These lapped surfaces are the critical measuring faces across which a micrometer or vernier caliper reading has to be taken to ascertain distance (S).

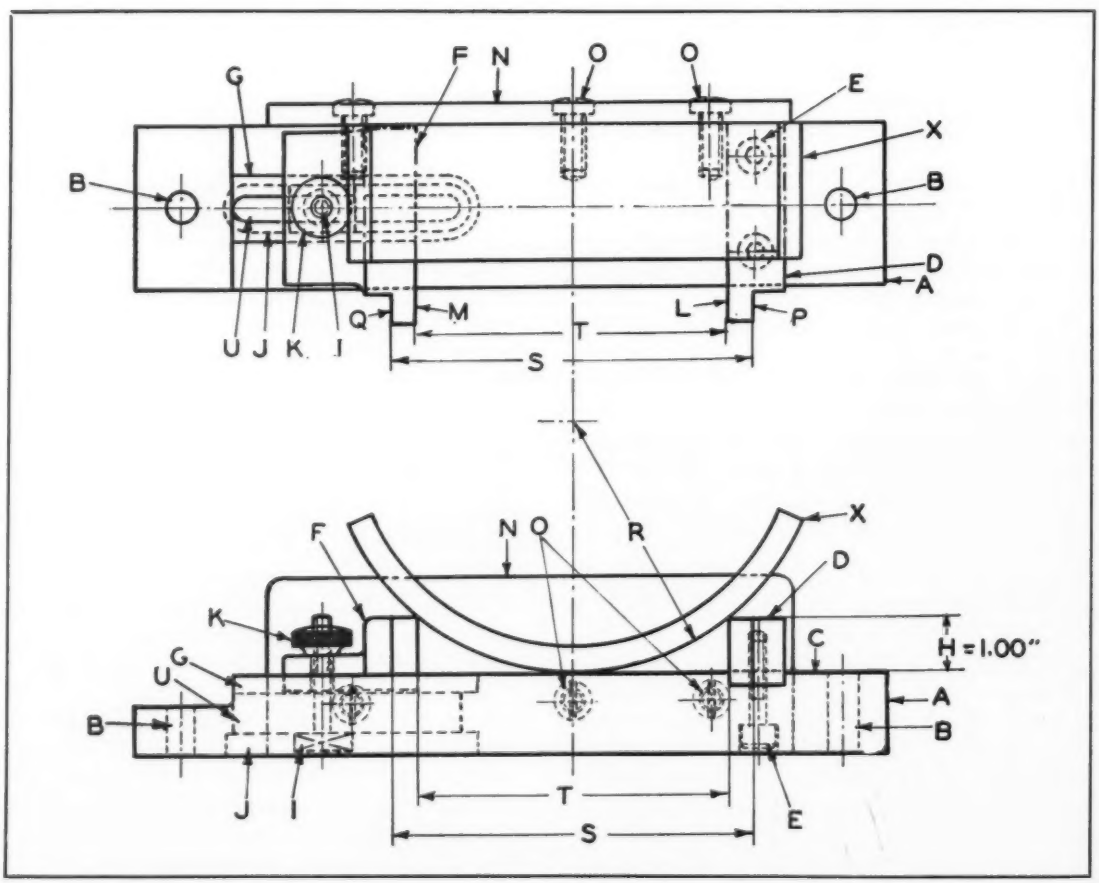
The segment (X) being gaged is located transversely across surface (C) by means of the steel stop-plate (N) secured by three screws (O) to the rear long side of the base (A). The stop-plate projects an ample distance above surface (C) to provide adequate location for each of the 4 sizes of segments which are to be gaged.

The diagrams show a segment (X) mounted on the fixture in readiness for determining its OD. The component is simply rested on the ground surface (C) with its rear side abutting closely against stop-plate (N), in which position it lies in correct axial alignment with the base, and with its curved periphery lying parallel to block (D) and slider (F) as shown.

The segment is rocked a slight amount in a rightward direction until its curved outside edge rests precisely on the edge of the fixed block (D). Slider (F) is released and carefully adjusted by hand towards the right until its highest portion is similarly brought into light contact with the periphery of the segment. The slider is then fastened to the base by nut (K). When set in this manner the periphery of the segment contacts at three points with the fixture members.

A micrometer or vernier-caliper reading is next taken over the lapped measuring faces (P) and (Q) to obtain the distance (S). This measured dimension is then reduced by an amount equal to twice the thickness of each lapped portion (L) and (M), which in this present example is 0.500". This gives the dimension (T), which is actually the length of chord across the segment at a height of 1.00" above surface (C).

Having ascertained these values by direct precision measurement on the segment, its outside diameter may be accurately determined in quick fashion by the simple formula as follows:



(1) $R = \frac{T^2}{8H} + \frac{H}{2}$ where:—

R is the radius of the segment.

T is the measured length of chord.

H is the height of chord determined by the height of block (D) and slider (F) above the surface (C).

The value derived from the application of this formula is simply multiplied by 2 to obtain the required OD of the segment. This is obtained to exceedingly close precision limits and thus affords an accurate check on the size of a particular segment, and indicates to the machinist the diameter of recess to be bored in the casing to ensure the segment will fit in the desired manner.

The fixture is easily and quickly adapted to deal with the various sizes of segment; it only is necessary to adjust the slider part (F) to suit each part and to establish the critical three-point contact.

The gaging fixture is especially suitable and time-saving for use in measuring the OD of rolled-plates, etc., which are formed to an exceedingly large circular shape, e.g., 20′ or more in diameter. With components of this excessively large size, difficulties usually arise, because they are too large to mount upon a flat table, and of course ordinary templates or measuring instruments cannot be applied. Very often such large segments cannot be mounted so as to permit the exact center point to be transferred accurately to some adjacent stationary object.

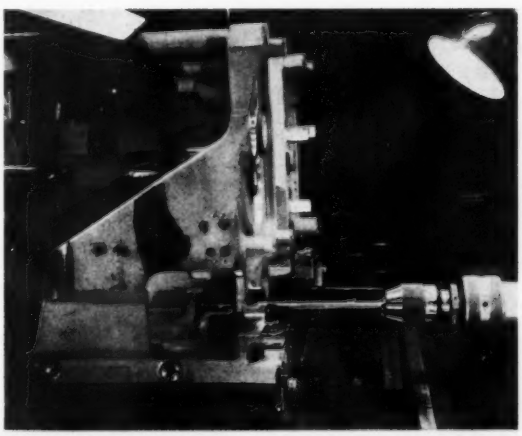
Parts of this character can, however, be readily measured with fine accuracy and simplicity by a gage of the type illustrated. In such cases the segment will simply be laid on the floor or the machine table with its curved surface uppermost. The gaging fixture will then be placed on the periphery of the segment close to one side and have its members set so as to obtain the accurate chord length, exactly as described.

The fixture is extremely simple and inexpensive in construction; it is easy to manipulate and adjust to suit different sizes of segments, and ensures precision accuracy in determining the OD of large components having a true circular curvature.

end

Tap Extension Solves Awkward-Spot Tapping Problems

Tapping a remote blind hole on a gear train housing for a radar assembly can be a tedious and ticklish job. Curran Machine Works, a Long Island City job shop specializing in unusual types of problem jobs, however, simplifies the job by using a tap extension.



Remote blind hole tapping a gear train housing with a tap extension.

Use of problem-solving tools, such as the tap extension, considerably reduces the amount of time and labor needed for jobs where hard-to-get-at tapping spots can slow production and increase costs. "If we had to order special extension taps for each job," explains Ray Curran, "we'd not only waste a lot of time, but the costs would be greatly increased. The extensions eliminate the need for expensive pulley taps. They're designed so that dull or broken taps can be changed by hand without the use of wrenches, pliers, or other hand tools."

The tap extensions used by Curran are manufactured by Ritmar Corp. in standard 9″ lengths or, for special applications, up to 36″ long.

end

Machining Troubles Detected by Motor Load Measurement

Overloading and machine breakage on rolling mill operation controlled by the use of a Loadmeter.

PRECISE ELECTRICAL LOAD MEASUREMENT gives machine operators a "tool" for spotting trouble while it is still in the making.

Experience of production engineers at General Electric's Metallurgical Products Department with load measuring equipment, has demonstrated the feasibility of this method of control. They have spotted such diverse troubles as dull tools, hard parts, and loaded grinding wheels before damage was done.

The device used is the Loadmeter, a product of Futurmill, Inc. It is essentially an ammeter (made for a-c or d-c current), which can be calibrated for various amperage ranges. Easily installed, this setup gives direct readings of the load reflected through the motor, in terms of the percent of full rated load.

Almost any malfunction of a machine so equipped is reflected in the load on the machine, measured, and caught before damage occurs.

Application of the Loadmeter to these different types of machines and equipment will show up any trouble developing and indicate a warning for corrective action:

- Multiple spindle grinder. Troubles encountered consist of oversize pieces of stock or loaded wheels. These are not distinguishable by sound when several wheels are operating, but they are reflected in the load on the motors driving the wheels.
- Milling machine. Milling cutters becoming dull or cuts that are too heavy for the machine are indicated by the meter.
- Rolling mill. It indicates when stock is too hard or too cold to be rolled. Shear pin breakage has been eliminated.
- Lathe. Instrument tells operator how heavy a cut he can take and also spots dulling tools before they are damaged.
- Stoker. Foreign matter in the fuel (railroad spikes, etc.) is caught before the feed is damaged, or pins in the gear box sheared.
- Vibrator-fed hammermill. Hopper is kept full for maximum production, but never overloaded.
- Conveyor. If barrels of abrasive compound are conveyed from one floor to another, occasionally a barrel will jam enroute with not much loss in material, but considerable conveyor downtime and cleanup. Now the meter shuts off the conveyor motor drive before the jammed barrel is broken, resulting in no more downtime.

This type of meter has two definite advantages — installation is simple and no protection from high voltage leads is necessary, and it is sensitive at the high end of the scale, where accuracy in process control is crucial.

Other advantages in the use of the Loadmeter are: the ability to know if machines are operating near their capacity, if feeds are up where they should be, and if production is approaching its full potential.

Probably more time is lost through the under use of modern machinery than from all the multitude of troubles inherent in shop operations.

end

This lathe operates at 100% load, safely.

How to Simplify Measurement of Distance Between Hole Centers

by Wayne E. Tinker
Chief Pneumatics Engineer
PRATT & WHITNEY COMPANY, INC.
West Hartford, Connecticut

A NEW METHOD of measuring between the centers of holes, that eliminates the lengthy computations formerly associated with measuring such distances, has been devised by the Gage Division of Pratt & Whitney Company in West Hartford, Connecticut. Many manufacturers of automotive parts, refrigerator parts, and pump housings have found this to be the most economical and accurate method now in use. The major advantage of this system is that it measures center distance variations independent of hole size variations, a tremendous advantage to the Inspector.

This simplified method of measuring the distance between two holes can be explained as follows:

Two air gage plugs are mounted on a common base with their centers set to a specified distance, let us say 4.000″. Each of these plugs has two independent nozzles which are connected to a duplex type indicator as shown in Figure 1. The two nozzles which are facing each other are connected together and thence to the inner pointer of the indicator. The two nozzles which are facing away from each other are connected together and thence to the outer pointer of the indicator.

In Figure 1, the product is shown as having a center-to-center distance greater than the desired basic 4.000″. Consequently, the two nozzles facing each other find a small distance to the wall they are "seeing" and this shows up on the indicator as the inner pointer moves toward the high pressure (plus) end of the scale. Conversely, because the nozzles facing away from each other are "seeing" a greater distance to the wall, more air can escape from the nozzles, and the outer pointer falls toward the low pressure (minus) end of its scale.

If the product holes are closer together than the basic 4.000″ dimension, the position of pointers will be as shown in Figure 2 which represents the reverse of the product condition shown in Figure 1.

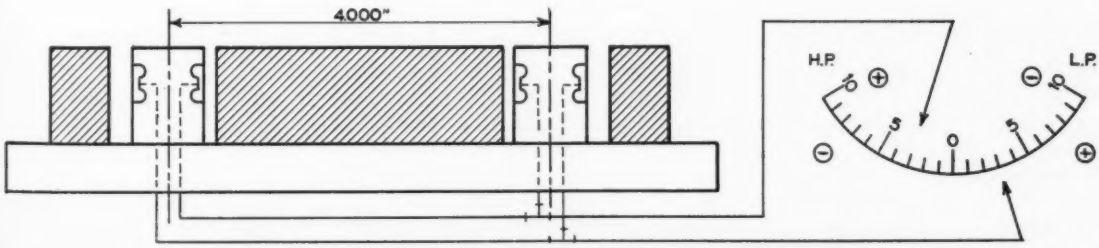


Fig. 1. The air gage plugs are mounted at the basic 4.000″ center-to-center distance. Product holes have a greater center-to-center distance, hence the duplex gage pointers have both moved into the plus side of the scales.

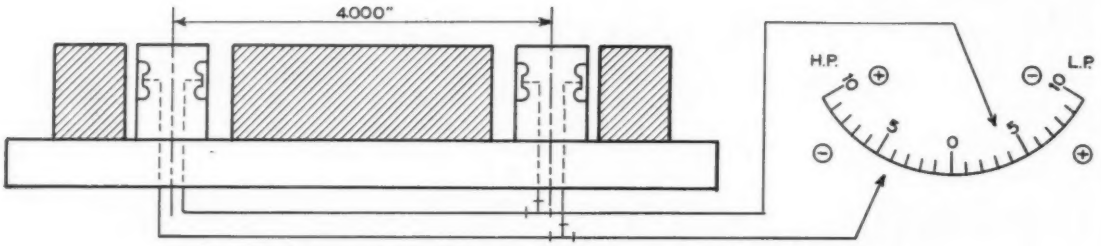


Fig. 2. The opposite condition from that of Figure 1. Product holes center-to-center distance is less than basic, so the pointers have moved into the minus sides of the scales.

The only time that the pointers will be in line with each other is when the centers of the two holes are the basic distance of 4.000″ apart.

Nominal variations in hole sizes are of no consequence to the center distance measurement. Change of the size of the hole has only the effect of causing a "zero shift" and does not affect the relationship of the pointers to each other. This is demonstrated by Figure 3.

The solid lines of Figure 3 represent a product with both holes to minimum size and centered exactly 4.000″ apart. The broken lines around the left hand plug represent the product holes as having the same basic 4.000″ center distance but with the one hole diameter increased to the maximum allowed by tolerance. The pointers shown as broken lines illustrate the "zero shift" but also show that the holes retain the basic 4.000″ center distance because the pointers are still in alignment with each other.

The pointers will shift similarly to the high pressure side of the scale if either one (or both) of the holes is reduced in size.

No particular care is required in positioning the products (or masters) in gaging position. This is due to the fact that this method of measuring is automatically self-balancing. The two nozzles facing each other being connected together form, in effect, a simple outside measurement, and the two nozzles facing away from each other form an inside measuring function when connected together.

Assume the product is shifted in one direction; as it approaches one of the nozzles of each circuit, it recedes from the other nozzle of the same circuit. Thus, the restricting effect on any nozzle is counter-balanced by the additional clearance "seen" by the other nozzle of the same circuit. Consequently, the respective pointers are uninfluenced, in their job of indicating true center-to-center distance, by the actual positioning of the product being measured.

The gaging setup can be calibrated (the establishing of correct magnification by the air circuit in conformance to the dial scale values) in either of two ways.

By careful selection and measurements, specimen products could be set aside and used as gage setting masters. This, however, has the obvious disadvantage that the products usually are not hardened and would soon wear beyond tolerance limits.

The second method is to manufacture accurate, calibrated, min. and max. setting masters. There are several possible methods of producing setting masters for this type of gage. These are shown in Figures 4, 5, and 6.

Solid, one-piece masters, Figure 4, are rather hazardous to make because of the difficulties that would be encountered in correcting and reworking.

Figure 5 represents a two-piece (tongue and groove) master which can be reworked and reconditioned much more conveniently. Its

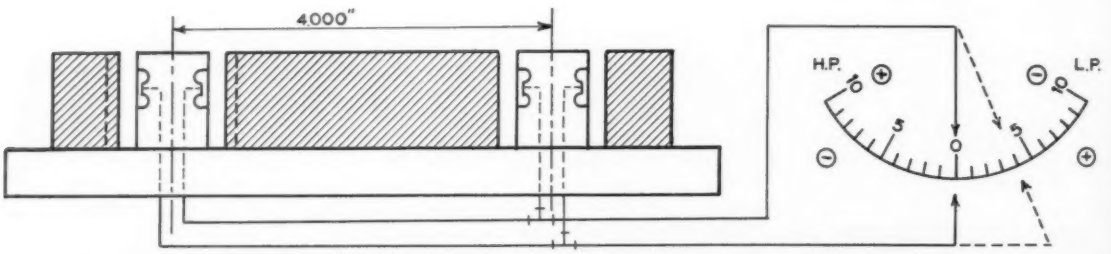


Fig. 3. Nominal variations in product hole size, as shown at left, do not affect center-to-center distance measurement, but simply cause a "zero shift" of the pointers. With the pointers remaining in alignment, the product hole center-to-center distance is indicated as still being the basic 4.000″.

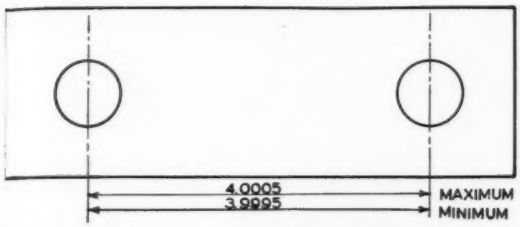


Fig. 4. Solid, one-piece, setting masters (one for the max. C.D. of 3.9995") are not advocated because of difficulties in correcting and reworking.

center-to-center distance can be reduced by grinding across the end surfaces of piece A, or increased by plating the end of A and then grinding back to attain correct center-to-center distance. Generous clearance between the end of the tongue on B and the bottom of the groove in A precludes any interference with these correcting operations. The widths of the tongue and groove should offer a snug fit to maintain constancy of hole centers alignment.

A two-in-one (min. and max.) master is shown in Figure 6. The shift is attained by rotating an eccentric bushing 180° between fixed stops. This effects the change from maximum center distance to minimum center distance and vice versa.

When making these setting masters, great care must be taken in the final measurements of the masters and in the marking of them for identification. They must be checked by the method shown in Figure 7 to insure proper calibration marks on the duplex indicator.

The above-mentioned outside and inside measurements actually are measurements of the distances between the outside walls of the two holes in the one instance, and between the inside walls of the two holes in the other. In later (and mathematical) portions of the text, they are symbolized as OM (outside metal-to-metal dimension) and IM (inside metal-to-metal dimension).

At this point, an explanation of the construction and functioning of the Pratt & Whitney duplex indicator will assist the reader in following the calibration and calculation procedures that follow.

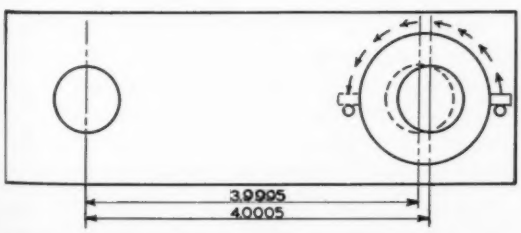


Fig. 6. A two-in-one (min. and max.) master. Rotating an eccentric bushing 180° effects the change between min. and max. center distances.

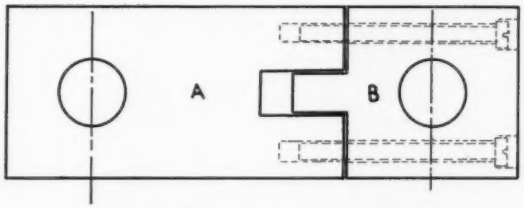


Fig. 5. A two-piece (tongue and groove) master which can be reworked and reconditioned more conveniently. Its hole center-to-center can be reduced by grinding or increased by plating.

The duplex indicator consists of actually two separate air pressure-actuated mechanisms with indicating pointers housed in the same case. One pointer operates in front of the scale and is called the inside pointer. The second pointer operates behind the dial, but its indicating tip is brought around the outer edge of the dial so that the same scale graduations serve both pointers, and it is called the outside pointer.

The inside pointer, in this application, is connected to the IM (inside metal-to-metal) measuring nozzles, and the outside pointer is connected to the OM (outside metal-to-metal) measuring nozzles. This means the right hand side of the scale is the low pressure side for both IM and OM measurements.

However, because the IM measurement is taken with nozzles facing toward each other,

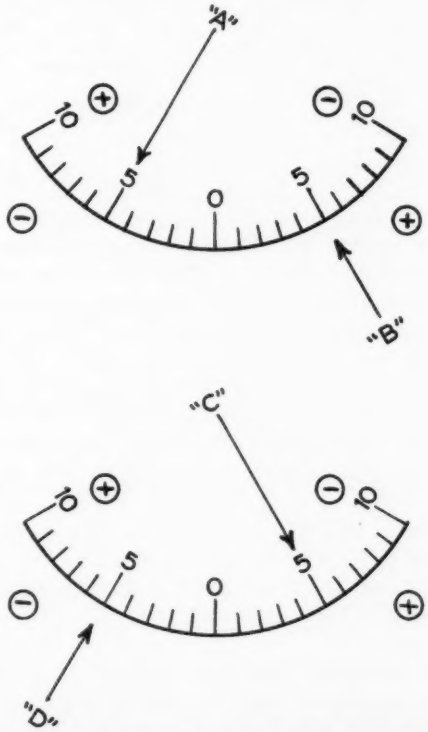
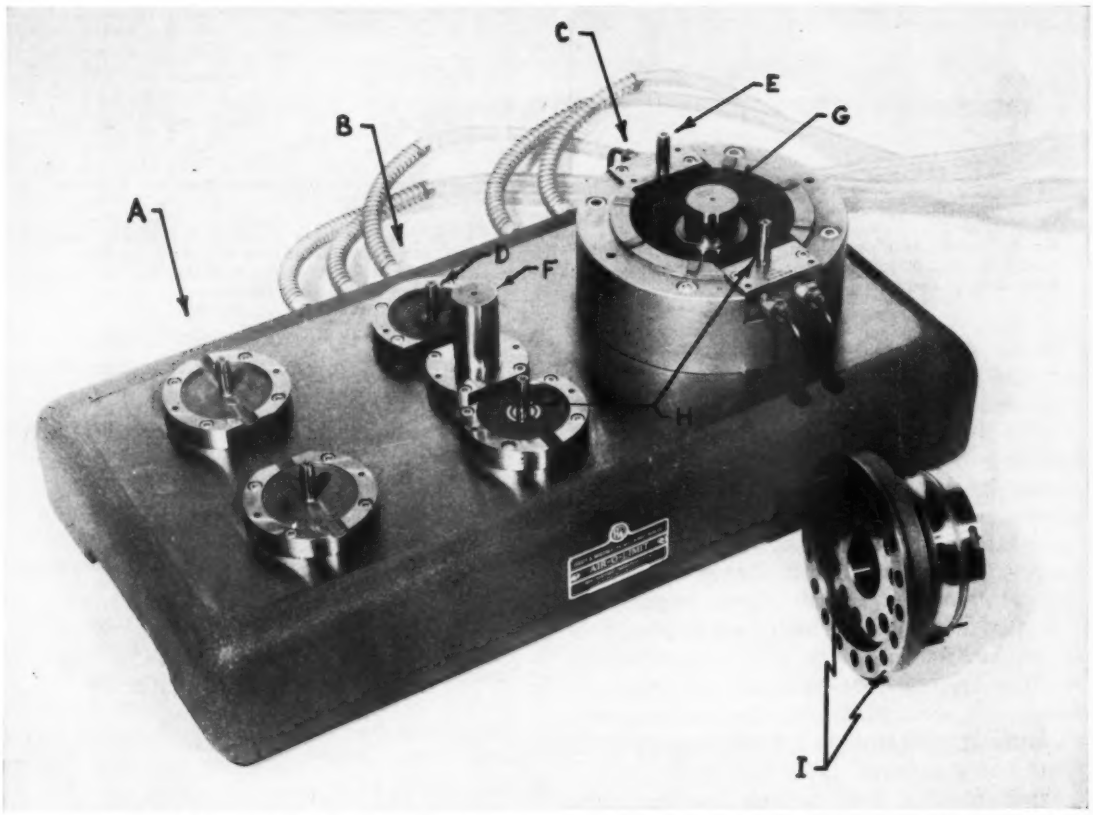


Fig. 7. Showing the duplex indicator pointer positions corresponding to the inside and outside metal-to-metal dimensions of the min. and max. masters.



A Pratt & Whitney Centerline and Alignment Gage developed and built for the aviation division of Sundstrand Machine Tool Company. Its three stations, A, B and C, measure centerline distance of bolt circle holes and the alignment of dowel holes in relation to the main bore of the pump housing in foreground. The gage also handles the checking of a mating motor housing, not shown.

Station A checks bolt circle diameter of both components. At station B the motor housing is inspected for bolt circle radius and alignment of dowel holes with center hole, while station C accommodates the pump housing for the same checks.

Pins D and E are guide pins only for locating work on gage fixture.

Plugs F and G have single nozzles at 90° to center distance nozzles to check alignment of dowel holes I with main bore.

Pins H are center distance plugs working in conjunction with main bore plugs F and G.

any increase in product hole centers distance will reduce the nozzle clearances thereby causing a higher back pressure which will deflect the inside pointer to the left side of the scale.

Simultaneously, this increase in product hole centers distance causes the OM nozzles, which are facing away from each other, to "see" a larger wall clearance and of the same magnitude. This correspondingly lowers the back pressure in the OM circuit thus deflecting the outside pointer to the right side of the scale.

This is why the left hand end of the scale is marked "plus" for the inside (IM) pointer's travel and the right hand end of the scale is marked "plus" for the outside (OM) pointer's travel.

By the same token, a decrease in product holes center distance reverses the pointers' movements, so a "minus" mark is provided at the right hand end of the scale for the inside (IM) pointer, and a "minus" mark is added to the left hand end of the scale for the outside (OM) pointer.

For those who are mathematically inclined and want to follow the calculations for an inspection job and for establishing the min. and max. setting masters, we present the following problem represented by Figure 7-A.

Assumed: Product having two holes at a center-to-center distance of 4.000" ±.0005. One hole has a diameter of 0.320" $^{+.0005}_{-.0000}$ and the other a diameter of 0.500" $^{+.0005}_{-.0000}$.

We are primarily concerned with measuring center distance variations and, as outlined, this is accomplished on the Pratt & Whitney Centerline Distance and Alignment Comparator by measuring between the inside and outside surfaces of the hole walls.

To determine the clearance between the product and the nozzles at zero position on the indicator, it is necessary to calculate the zero or mean position of the product as follows:

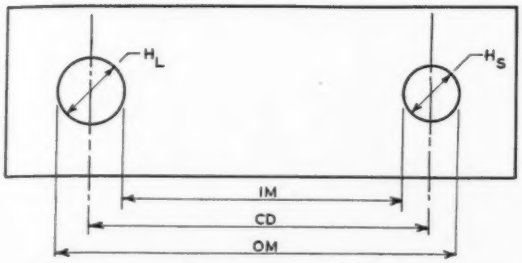


Fig. 7-A. The calculations presented in the text for an inspection job and for establishing the min. and max. setting masters are based on: a product having two holes at a center-to-center distance of 4.000" ±.0005; one hole having a diameter of 0.320" (+ .0005,-.0000), and the other a diameter of 0.500" (+ .0005,-.0000).

$$CD = 4.000 \pm .0005 \text{ hence } CD_o = 4.000$$

$$H_L = 0.500 \ {}^{+.005}_{-.0000} \text{ hence } H_{Lo} = 0.50025$$

$$H_S = 0.320 \ {}^{+.005}_{-.0000} \text{ hence } H_{So} = 0.32025$$

$$IM_o = CD_o - \left(\frac{H_{Lo} + H_{So}}{2}\right)$$

$$= 4.000 - \left(\frac{0.50025 + 0.32025}{2}\right)$$

$$= 3.58975$$

and

$$OM_o = CD_o + \left(\frac{H_{Lo} + H_{So}}{2}\right)$$

$$= 4.000 + \left(\frac{0.50025 + 0.32025}{2}\right)$$

$$4.41025$$

H_L	=	Large hole diameter
H_S	=	Small hole diameter
CD	=	Center distance
IM	=	Inside metal-to-metal dimension
OM	=	Outside metal-to-metal dimension
o	=	Mean dimension (nominal)
n	=	Min. dimension (calculated)
x	=	Max. dimension (calculated)
a	=	Actual measurement
an	=	Actual measurement of min. master
ax	=	Actual measurement of max. master

IM_o and OM_o are reference figures for the zero position of the pointers and consequently are marked on the duplex indicator face for a permanent record of the basic product dimensions. This is shown in Figure 7-B.

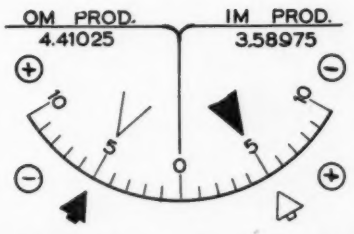


Fig. 7-B. A permanent record of the nominal IM and OM product dimensions is marked on the face of the indicator.

The min. master dimensions are then calculated, using min. center distance (CD_n) with mean hole diameters (H_{Lo} and H_{So}), thusly:

$$IM_n = IM_o - \left(\frac{\text{CD tolerance}}{2}\right)$$

$$= 3.58975 - \left(\frac{0.001}{2}\right)$$

$$= 3.58925$$

$$CD_n = CD_o - \left(\frac{\text{CD tolerance}}{2}\right)$$

$$= 4.0000 - \left(\frac{0.001}{2}\right)$$

$$= 3.9995$$

$$OM_n = OM_o - \left(\frac{\text{CD tolerance}}{2}\right)$$

$$= 4.41025 - \left(\frac{0.001}{2}\right)$$

$$= 4.40975$$

The max. master dimensions are next calculated, using max. center distance (CD_x) and mean hole diameters (H_{Lo} and H_{So}) as follows:

$$IM_x = IM_o + \left(\frac{\text{CD tolerance}}{2}\right)$$

$$= 3.58975 + \left(\frac{0.001}{2}\right)$$

$$= 3.59025$$

$$CD_x = CD_o + \left(\frac{\text{CD tolerance}}{2}\right)$$

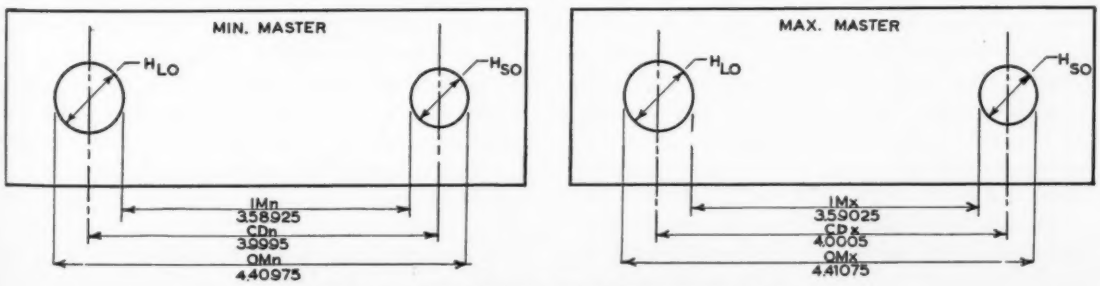
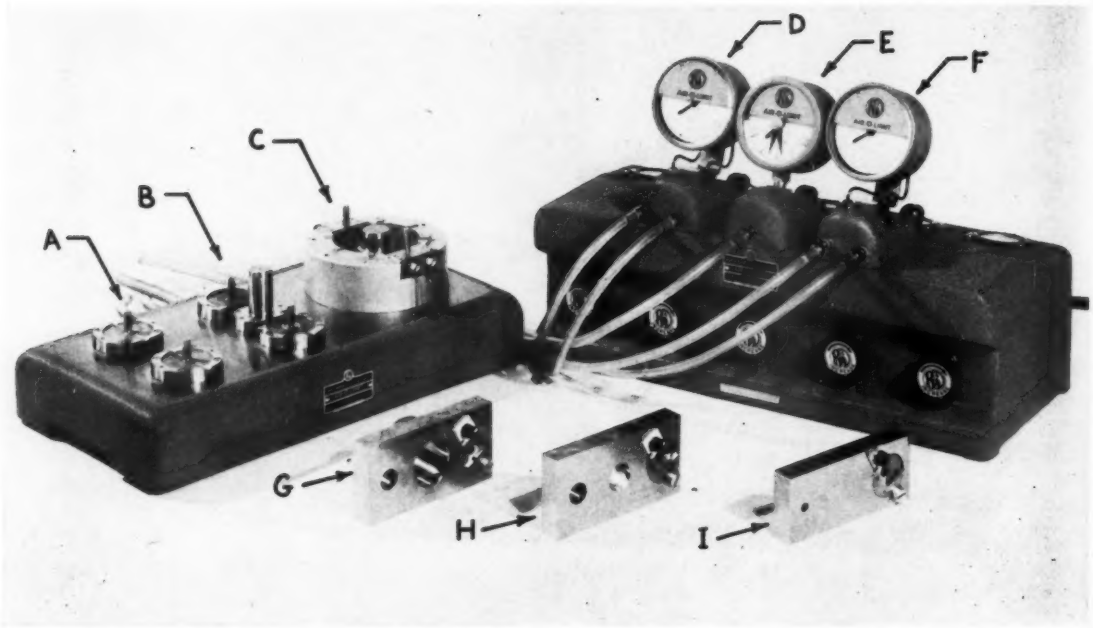


Fig. 7-C. The calculated (ideal on theoretical) dimensions for the min. and max. setting masters.



The complete gaging setup consists of the Pratt & Whitney Centerline and Alignment Gage with its Air-O-Limit comparator stand plus the setting masters required to establish correct calibration of the measuring indicators.

In operation station A is connected at all times, while stations B and C are alternately connected as required for checking pump housing or motor housing.

Indicator D gives IM and OM of diametrically opposite bolt circle holes.

Indicator E reads hole alignment of dowel holes with main bore.

Indicator F checks IM and OM on bolt circle radius. Setting masters G and H, for stations B and C, are of the "two-in-one" construction shown in Figure 6. The oversize guide holes at the left end of each allow for the displacement, relative to pins D and E, caused by rotating the eccentric bushing to min. and max. center distance settings.

Station A is calibrated by the "two-in-one" master shown at I.

$$= 4.0000 + \left(\frac{0.001}{2}\right)$$

$$= 4.0005$$

$$OM_x = OM_o + \left(\frac{\text{CD tolerance}}{2}\right)$$

$$= 4.41025 + \left(\frac{0.001}{2}\right)$$

$$= 4.41075$$

These min. and max. calculated dimensions are shown in Figure 7-C.

In Figure 7-B the pointer positions are shown corresponding to the calculated values for IM_n, OM_n, IM_x and OM_x, Figure 7-C, and which are the dimensional values to be shot at in making the min. and max. setting masters.

Obviously, however, the masters will vary from the ideal on calculated dimensions because of the inherent variables encountered in gage making. Consequently, when the masters have been completed they are accurately measured by contacting the hole walls at the same height as the nozzle locations. These measurements are made to the fifth decimal place.

The min. and max. masters are marked to correspond to these actual measurements, Figure 7-D, and calibration reference markers are placed on the face of the gage to be used in the inspection setup, as shown in Figure 7-E.

Let us assume, now, that the inspection problem so far, takes this turn:

The actual measurement (a) of OM_x on the max. master (O Max, Figure 7-D) is $+0.00045''$ from the basic OM, instead of the $+0.0005''$ as calculated. Therefore, a calibration mark for the max. position is placed at $+0.00045''$ from basic (zero) on the outer scale (Mark No. 1, Fig. 7-E).

The actual measurement of IM_x on the max. master (IM_{ax}, Figure 7-D) is $+0.00035''$ from the basic IM (instead of the calculated $+0.0005''$), so a calibration mark for this max. position is placed at $+0.00035''$ from basic on the inner scale (Mark No. 2, Figure 7-E).

The same procedure is repeated for the min. master and we find actual measurement of OM_n on the min. master (OM_{an}, Figure 7-D) to be -0.00047 from basic. This constitutes Mark No. 3 of Figure 7-E. With the actual measurement of IM_n on the min. master (IM_{an}, Figure 7-D) found to be $-0.00060''$ from the basic IM, calibration Mark No. 4 is placed at $-0.00060''$ on the inner scale.

It now becomes possible, with the min. and max. setting masters made, measured, and marked, and with the four reference marks

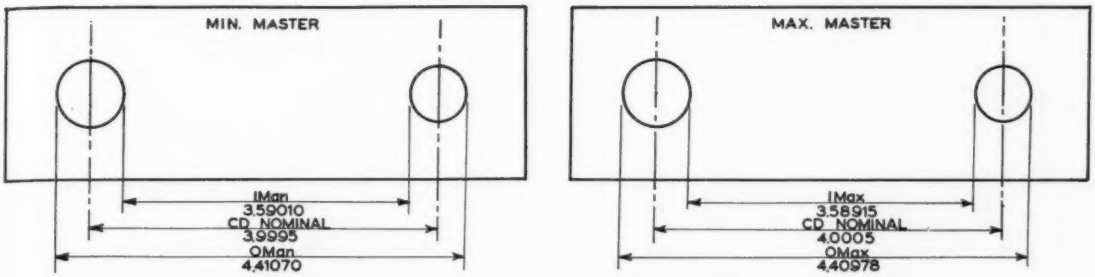


Fig. 7-D. The min. and max. setting masters are marked in accordance with their actual measurements to the fifth decimal.

(corresponding to the measured IM and OM values of the min. and max. masters) shown on the scale, Figure 7-E, to "calibrate" the gage for exact magnification in terms of the scale division, i.e. 0.0001″ on the scale equals 0.0001″ on the work.

This is done by so adjusting the air pressure regulator control of the IM and OM circuits that, as the min. and max. masters are positioned over the nozzles, the resultant travels of the inner and outer pointers conform to the limits or values indicated on the scale by the respective calibration markers (No. 1, No. 2, No. 3 and No. 4 of Figure 7-E).

Thus, with the duplex indicator so calibrated we can proceed with the checking of our product hole center-to-center distances to the limits represented by the dotted lines in Figure 7-E, or 4.0000″ ±0.0005.

In setting up air gaging equipment for hole center-to-center checking as described, there still remains a mental chore for the inspector to perform, i.e., that of dividing the scale spread between the pointers by two in order to get the actual dimensional value.

This is illustrated by Figure 8 wherein we show a center distance shift of only 0.0005″ from basic. However, both air circuits, IM and OM, "see" this change in one of the surfaces they are "looking" at, so each pointer responds in full to the 0.0005″ shift. This is why the resultant spread of 0.001″ between the pointers has to be divided by two in order to give the actual 0.0005″ shift.

This mental "halving" by the inspector can be eliminated by using the scale markings of Figure 8-A or by incorporating an air pressure differential relay in the air circuitry, according to Figure 8-B.

The scale divisions of Figure 8-A represent increments of 0.0001″, and are so identified, i.e. as 10-0-10. However, by using the additional scale markings of 0-5-0, the inspector reads the spread between the pointers of Figure 8 as 0.0005″ (2½ + 2½), the actual center-to-center shift.

Figure 8-B shows the addition of an air pressure differential relay to the air circuitry of the previous discussions. The input sides of the relay are tapped into the IM and OM nozzle circuits and the relay's output actuates a third air gage indicator to give a direct reading of center distance variations. Thus, the air pressure differential relay does the job of dividing by two.

Another feature that has been incorporated in the Pratt & Whitney Centerline Distance and Alignment Comparator shown in the accompanying photographs is that of checking alignment of two dowel holes with the main bore in a pump housing. Such a three-hole alignment check is easily accomplished by the arrangement shown schematically in Figure 9 which represents a single nozzle plug and two locating pins.

The upper view, Figure 9, is of the product applied in its first position. The reading of the alignment indicator pointer is noted. Then the product is rotated 180° to the position shown in the lower view of Figure 9, and a notation is made of the pointer's position. The actual amount that the center hole is offset in relation to the two outer holes will be one half of the difference between the two pointer positions.

A relatively simple, easily adjustable master, Figure 10, can be made for calibrating, or

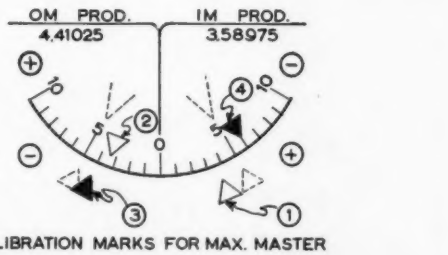


Fig. 7-E. Calibration marks are placed on the duplex indicator scale corresponding to the actual measurements made of the min. and max. masters.

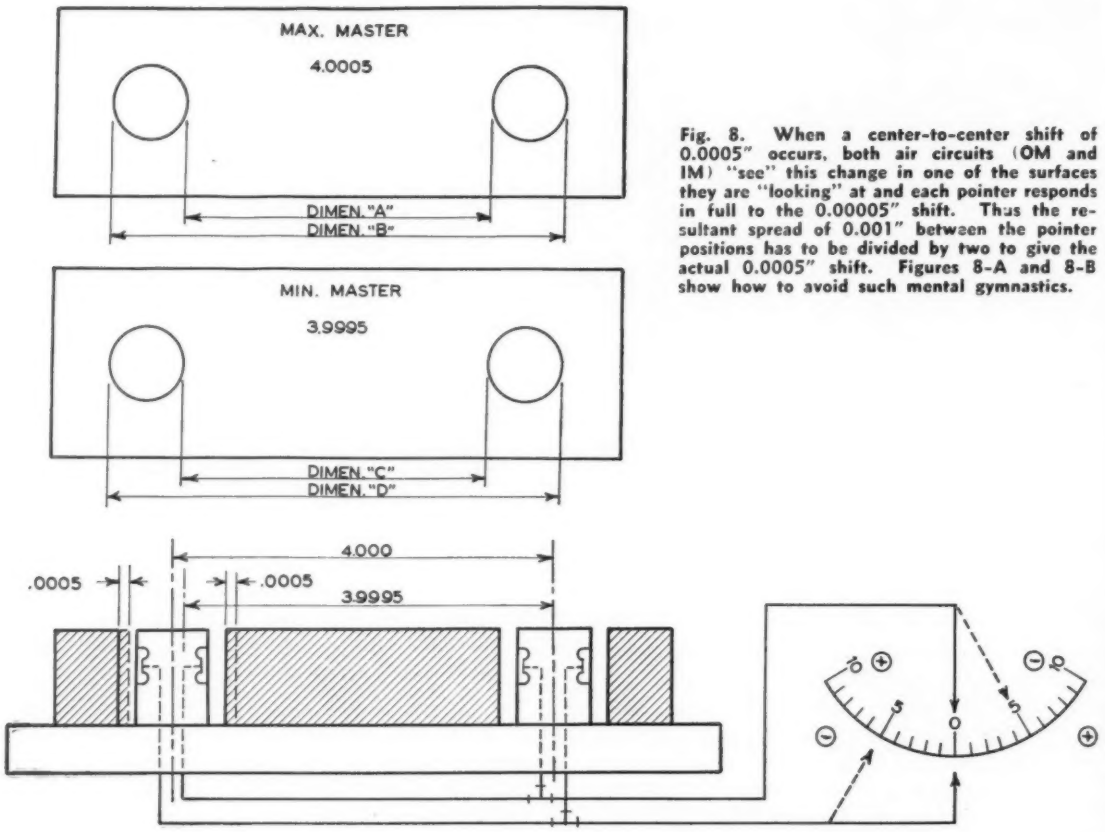


Fig. 8. When a center-to-center shift of 0.0005" occurs, both air circuits (OM and IM) "see" this change in one of the surfaces they are "looking" at and each pointer responds in full to the 0.00005" shift. Thus the resultant spread of 0.001" between the pointer positions has to be divided by two to give the actual 0.0005" shift. Figures 8-A and 8-B show how to avoid such mental gymnastics.

establishing magnification on this type of gage. The two adjustable anvils, which simulate the ID of the center hole, are positioned in relation to the edges of the outer holes, using the proper product center hole dimension. The difference in the two anvil settings, as seen by the single nozzle in the center plug, will be the amount that is desired to give an ample pointer spread for the magnification check.

The above method of alignment check has one possible disadvantage which occurs only if the holes to be checked are on different planes. In such an instance, the holes must be square with the locating face, or, in the event that they are not, then the amount of out-of-square must be known at nozzle height, and that amount halved and subtracted from the alignment reading.

This condition is illustrated in Figure 11, which shows an out-of-square hole causing a large gap at the nozzle. When this part is turned 180° the nozzle will see only a small gap. If the inspector is not aware of the out-of-square condition, he will interpret the change in pointer position as an alignment error when such may not be the case.

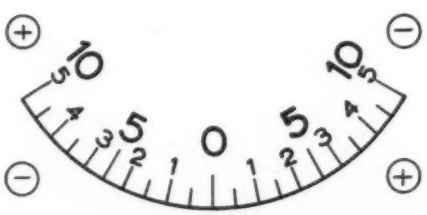


Fig. 8-A. The added markings (0-5-0) on this scale give the 0.0005" shift of Figure 8 simply by reading the spread between the pointers as 2½ + 2½.

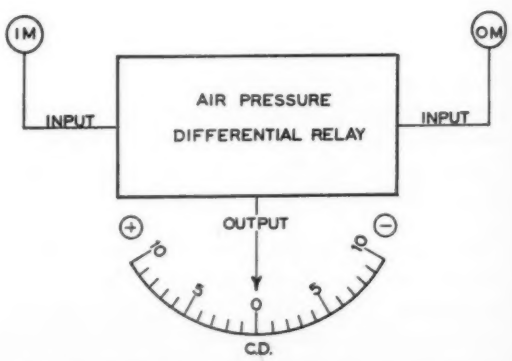


Fig. 8-B. With this circuitry, the air pressure differential relay does the job of dividing by two called for in Figure 8.

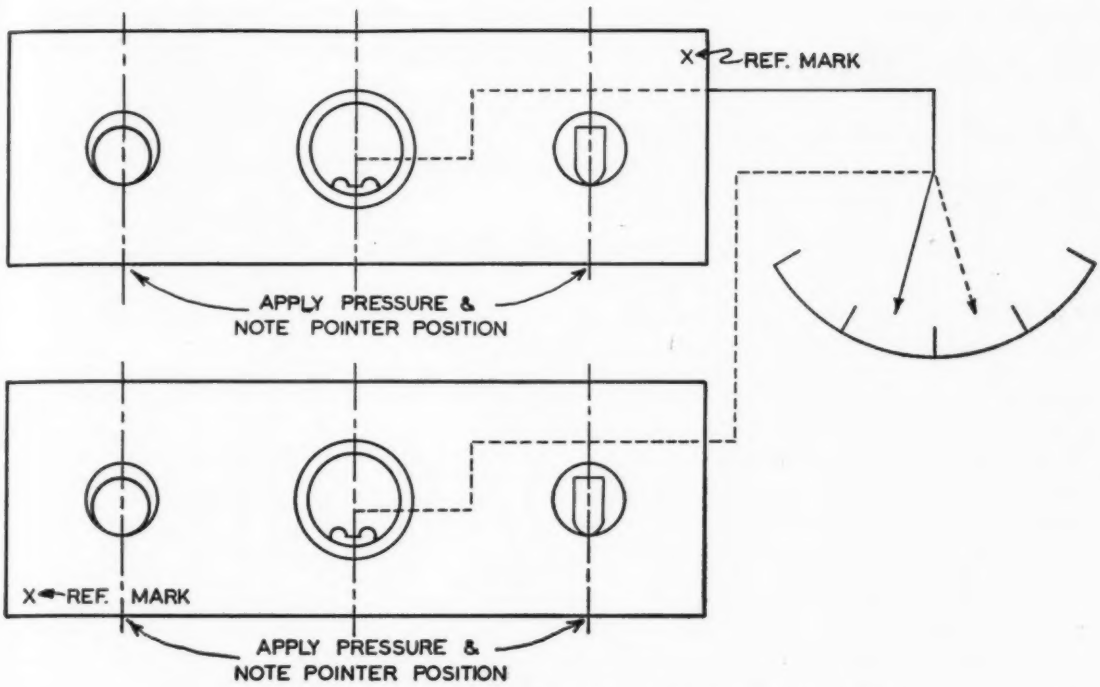


Fig. 9. An inspection setup for checking the alignment of three hole centers. The product is checked in two positions (upper and lower views) and any out-of-alignment will be one half of the difference between the two pointer readings.

In conclusion, this method of making hole center-to-center measurements is simple, fast and accurate, and discounts manufacturing tolerances on the sizes of the holes. Open type nozzles are used when surface finish in the holes is 50 rms or better, and contact type nozzles are used where surface finish is rougher than 50 rms. end

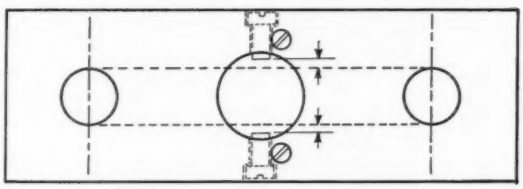


Fig. 10. An easily constructed and readily adjustable setting master for the job shown in Figure 9.

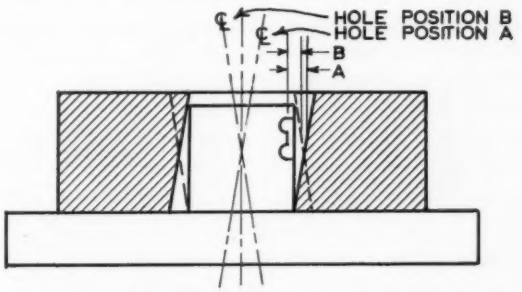


Fig. 11. What an "out-of-square" hole can do to the hole alignment check of Figure 9.

Next Month:

Cold Forming Takes the Spotlight in a Special Report

Metallurgy . . . Impact Extrusion . . . Cold Forging . . . Heading . . . Cold Extrusion . . . Deep Drawing . . . Swaging . . . Thread Rolling . . . and More

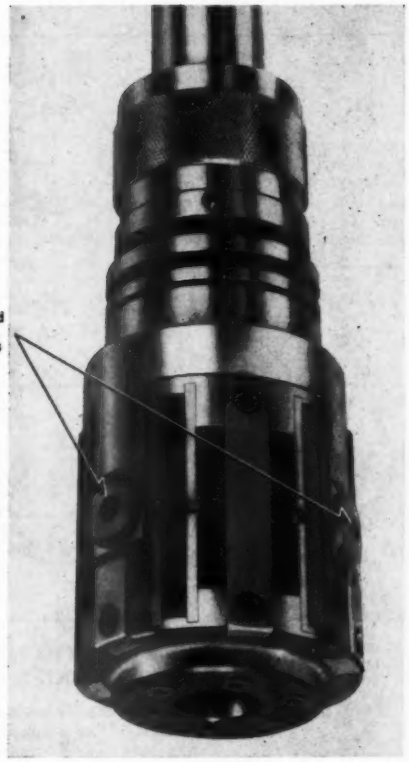
HONED BORES ARE AUTOMATICALLY SIZED DURING HONING CYCLE

AN IMPROVED METHOD has been developed for automatically gaging the ID of honed bores throughout their full length, while honing progresses.

Metered liquid coolant, directed against the cylinder wall through orifices in the honing tool until it reaches a preselected pressure point, accomplishes the actual sizing. As honing progresses, the bore increases in size causing the pressure to decrease. When the pressure has dropped to a given point, a limit switch is tripped to terminate the machine cycle, permitting the honing tool to complete its stroke and then withdraw from the bore.

If at any point the bore is not to size, the control system reactivates the cycle and honing continues until the entire bore is to size.

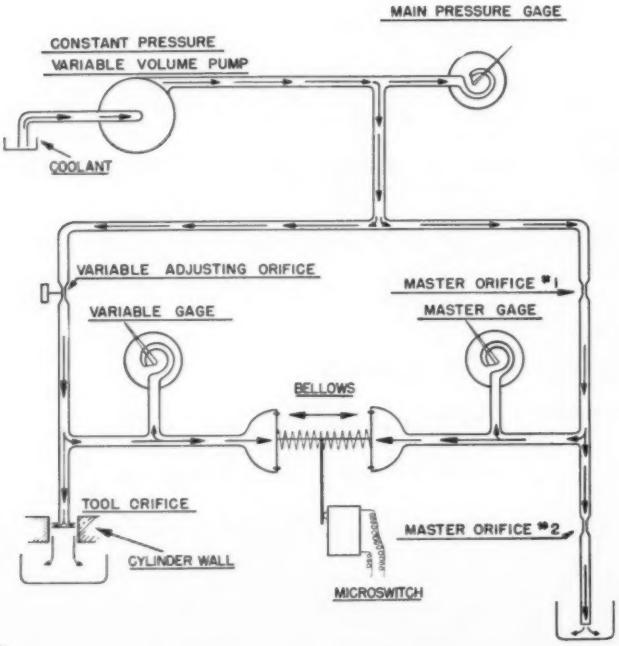
Known as Liquid Sizing, this method offers several advantages. Coolant is flooded over the cylinder walls at the most critical point during the honing cycle, thus better heat control is effected. This also provides continuous flushing which materially increases the stone life and permits better micro-finish control.



A new Barnesdril plate-type honing tool showing orifices from which coolant is metered.

In addition, new BarnesdriL plate type honing tools are utilized. They are constructed for low maintenance cost and ease of stone replacement.

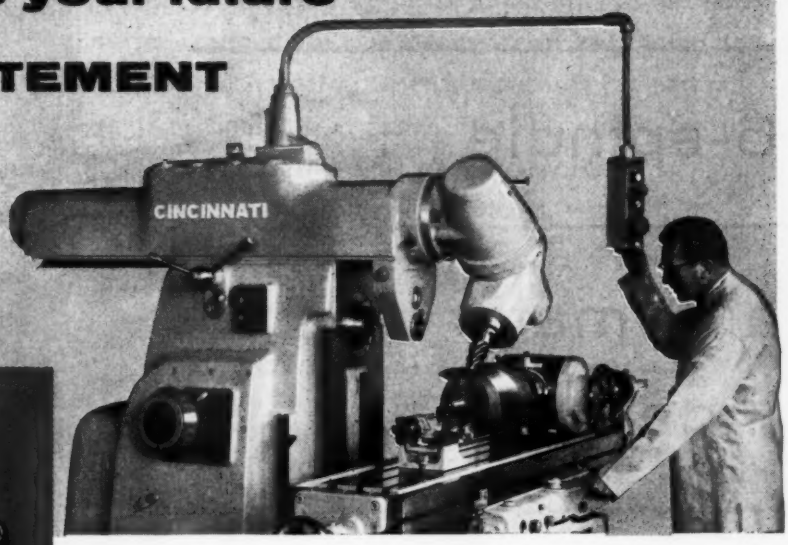
This method of sizing honed bores was developed by Barnes Drill Co. engineers. end



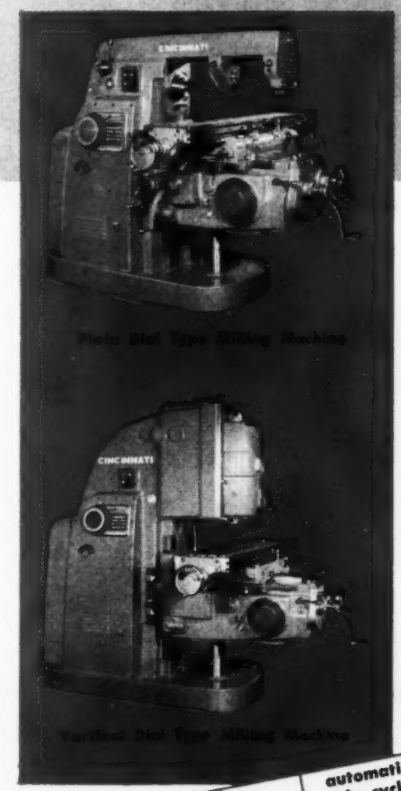
Liquid Sizing supplies coolant at a constant pressure to both the tool and the master gage. Back pressure, created by forcing coolant between the tool and walls of cylinder, affects the expansion of the bellows. As honing progresses, the distance between the tool and the wall increases, causing back pressure to decrease and the bellows to expand, until the point is reached where this variable pressure balances with the pre-set pressure on the master gage. At this point, a microswitch is tripped to conclude the honing machine cycle.

DIAL TYPES

will improve your future PROFIT STATEMENT



CINCINNATI



Universal Dial Type Milling Machine, equipped with Independent Overhead Spindle

The profit you make or would like to make today and several years hence may well depend upon the machine tools in your shop. Are they contributing their full share to the profit statement? Compare your milling operations, for example, with the results obtainable when assigned to the latest CINCINNATI® Dial Type Milling Machines. These machines have the potential to produce faster, more accurately and at lower cost than any other equipment in their classification. A few reasons why include:

Push-button front and rear selection of spindle speeds . . . power front and rear selection of feeds, 3/8" to 90" per min. . . . automatic backlash eliminator . . . Dynapoise chatter-damping overarm . . . automatic table feed cycles, if desired, for plain and vertical machines.

May we tell you more about CINCINNATI Dial Type Milling Machines? A complete list of Dial Type advantages and specifications is contained in catalog No. M-1915-2. Brief data will be found in Sweet's.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

DIAL TYPE LINE		table traverse	main drive	automatic table cycles available
No. 2	Plain	28"	10 hp	yes
	Universal			no
	Vertical			yes
No. 3	Plain	34"	15 hp	yes
	Universal			no
	Vertical			yes
No. 4	Plain	42"	20 hp	yes
	Universal			no
	Vertical			yes

CINCINNATI

MILLING MACHINES • BROACHING MACHINES • CUTTER AND TOOL GRINDERS • SPECIAL MACHINE TOOLS • METAL FORMING MACHINES • HARDENING MACHINES • CUTTING FLUID • GRINDING WHEELS

CIRCLE INFORM-A-GRAM KEY NO. 105

The NEW 3/8" capacity

6-spindle

automatic indexing

drilling and tapping

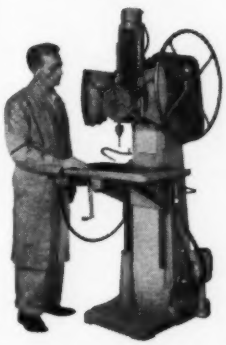
Burgmaster® Turret Drill

sensitive, fast **Model 1C**

Larger models in capacities

The Model 1C turret drilling and tapping machine expands the Burgmaster line to include a smaller capacity, sensitive feed, fast operating machine. It is built to the same rugged standard for rigidity and accuracy evident in the larger units. The Burgmaster principle of bringing the spindle to the work eliminates the necessity of realigning for each operation. This reduces scrap and cuts time and in many instances eliminates fixtures. This unit frees heavy duty machines for larger capacity work.

SPECIAL FEATURES



automatic indexing
7" spindle travel
preselective spindle speeds
precision depth control
sensitive hand feed
quick setup
close tolerances maintained
low maintenance cost
surface ground work table

SPECIFICATIONS

Drill Capacity in mild steel	3/8"
Tap Capacity in mild steel	5/16" N.F.
Drill Motor	1 HP, 2 Speed, 3 Phase, 60 Cycle
Turret—Spindle Travel	7"
Throat Depth	9 3/8"
Spindle Runout at Spindle Nose	.0003 TIR
Accuracy of depth control	.002"
Max. Tool Clearance	4 3/8" Diam.
Size of the Table	14" x 24"
Max. Clearance, Spindle Nose to Stand. Table	24"
Min. Clearance, Spindle Nose to Stand. Table	8 1/4"
Clearance Spindle to Base	42"
Max. Height	75"
Max. Width	27"
Max. Length	38"
Weight Uncrated	1000 lbs.
Weight Crated	1200 lbs.

20 minute, sound film available on request from any of our offices. Shows all models and new positioning table in action.

For complete information contact our nearest office or phone, wire or write Dept. TP 9

BURG TOOL Manufacturing Co., Inc.
15001 South Figueroa Street, Gardena, California

Burgmaster Sales Offices:

NEW JERSEY: 86 No. Maple Ave., Ridgewood, N. J. Phone: GIlbert 4-3002
CLEVELAND: 14706 Detroit Ave., Cleveland 7, Ohio. Phone: ACademy 6-7030
CHICAGO: 5329 Lincoln Ave., Chicago 25, Ill. Phone: LOng Beach 1-1178
DETROIT: 13730 W. 8-Mile Road, Detroit, Mich. Phone: LI 8-4333
SAN FRANCISCO BAY AREA: 857 Estabrook, San Leandro, Calif. Phone: LO 9-2244

from 3/4" to 1 1/2" are also available in hand operated, automatics and radials

CIRCLE INFORM-A-GRAM KEY NO. 107

VACUUM DEVICE FOR PRECISION DRILLING AIRCRAFT SKINS

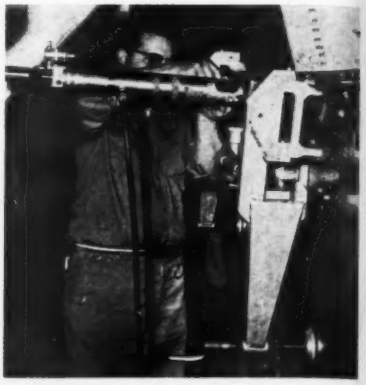
In building the P6M SeaMaster, the Navy's first multi-jet seaplane, Martin faced the problem of drilling and countersinking thousands of rivet holes in the skins.

Formerly, the procedure would have been to construct a laminated plastic fixture with properly spaced locating holes. This fixture would have been attached to the skin temporarily. However, such a fixture is costly to manufacture, unwieldy, and difficult to set up for normal 90° holes. The fixture also requires special storage and handling facilities.

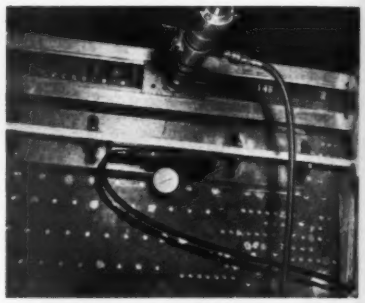
To do the job more accurately and economically, Martin has developed a vacuum assembly for holding an Airfeedrill in position.

The entire vacuum assembly has three parts — a vacuum plate, the slide assembly for holding the Airfeedrill, and a clamp at each end of the slide assembly. A Martin-developed venturi fitting draws the vacuum which holds the vacuum plate to the panel. This venturi fitting operates off the compressed air system.

Each end of the vacuum plate attaches to an adjustable clamp. These two clamps hold the slide assembly in place against the panel just above the vacuum plate. Pressure on the assembly is increased by tightening the clamps. Four feet on the slide assembly assure a 90° position of the drill.



Operator locking Airfeedrill into position in vacuum assembly.

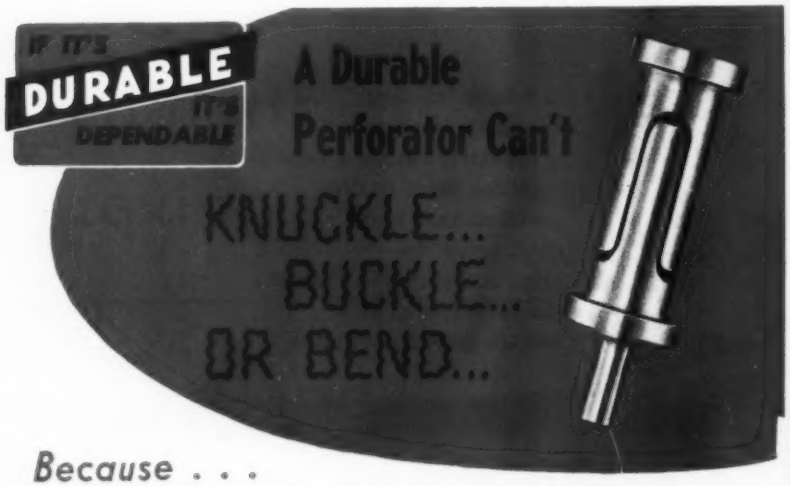


Front view of vacuum assembly attached to SeaMaster skin. At top center is Airfeedrill in position. Below this is the venturi fitting and gage which draws the vacuum. At bottom right and left are clamping discs.

A holding device holds the Airfeedrill and moves from one end of the slide assembly to the other. When it reaches the end, the vacuum is released and the entire assembly is moved to its next location.

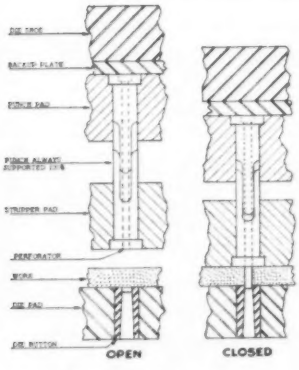
The entire assembly rests on a pair of tracks that are attached to the skin and located by positioning holes. Notches along the lower edge of the bottom track serve as locators for the Airfeedrill. When the drill is correctly placed, a lever in the holding device fits into a notch. The Airfeedrill is pre-adjusted so that it drills the hole and then countersinks it to the proper depth. After the hole is drilled, the lever is raised and the drill is moved along until the lever reaches the next notch.

The saving in time and tooling cost amounts to approximately 85% of the former cost; but more important is the improved accuracy which leads to fewer rejected fasteners.



Because . . .

WHEN PUNCHING IT IS 100% SUPPORTED BY A TELESCOPING SUPPORT-SLEEVE



Typical Installation

A Durable Perforator stays "alive" longer, because it is supported 100% the full stroke of its Telescoping Sleeve.

You get positive alignment, closer tolerances, burr free holes, regardless of the types of metal used. Holes are punched faster, easier and accurately.

Write For The New
DURABLE ENGINEER'S HANDBOOK
121 pages showing
100 Practical Die Designs.
NO CHARGE, NO OBLIGATION

Patented and made exclusively by
DURABLE PUNCH & DIE COMPANY
9030 South Hermitage St., Chicago 20, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 108

TECHNICAL BULLETIN
No. 106
Jergens Milling Machine Bushing
PERFORMANCE REPORT ON JERGENS MILLING MACHINE BUSHING FROM THE JEFFREY MFG. CO., COLUMBUS, OHIO
TECHNICAL BULLETIN
No. 104
Jergens Milling Machine Bushing
PERFORMANCE REPORT ON JERGENS MILLING MACHINE BUSHING FROM B-K MACHINE CO., WHITTIER, CALIFORNIA
TECHNICAL BULLETIN
NO. 103
Jergens Milling Machine Bushing
DONLEY PRODUCTS PERFORMANCE REPORT ON MILLING MACHINE BUSHING APPLICATION AT GENERAL ELECTRIC COMPANY, DIRECT CURRENT MOTOR AND GENERATOR DEPARTMENT, ERIE, PENNSYLVANIA
Milling blind keyways on armature shafts.
Replace bronze bushing on outer support with installation of a Jergens Milling Machine Bushing on a Gorton Model 3-48, Serial 35104 Milling Machine with Gorton 150 Milling Machine Adapter on outer support.
Donley Products, Inc.
11106 AVON AVE. • CLEVELAND 5, OHIO

free

TECHNICAL PERFORMANCE REPORTS SHOW HOW JERGENS LIVE BUSHINGS

save

$ MAINTENANCE DOLLARS
$ SCRAP LOSSES
$ UP PRODUCTION & PRECISION

HORIZONTAL MILLING MACHINE APPLICATIONS

Jergens Live Milling Machine Bushings replace the bronze bushings on the outer support. They increase maintainable feeds to make possible the advantageous use of carbide cutters. No additional machine power needed. They give longer cutter life, eliminate cutter breakage, and increase speed and precision of cutting. Jergens Live Milling Machine Bushings eliminate bushing wear, give greater arbor rigidity, resulting in minimum maintenance, elimination of twisted arbors, frozen bushings, and chatter.

PILOTING APPLICATIONS INCLUDING HORIZONTAL BORING MILLS, RADIAL DRILLS, ETC.

Jergens Live Roller Bearing Bushings are successfully used in thousands of applications to hold tolerance, reduce tool breakage, bar wear and scoring, chatter, and spindle bearing wear and increase speeds and feeds. Eliminate tolerance requirements for heat expansion. They are successfully used on older equipment to permit the advantageous use of carbide tools. They minimize bushing wear, reduce maintenance, increase production, and bring old machine tools up to new competitive levels.

Keep Competitive \ Keep Informed

Send for full information—today!

DONLEY PRODUCTS, INC.
11106 AVON AVE. • CLEVELAND 5, OHIO

☐ Please rush Jergens Live Bushing Performance Reports.
☐ Have salesman call.

NAME _____ TITLE _____
COMPANY _____
ADDRESS _____
CITY _____ STATE _____

CIRCLE INFORM-A-GRAM KEY NO. 109

Engineered with the quality features that make end milling jobs pay off

Engineered with the hardest practical grade of carbide to "breeze" through the toughest metal cutting applications.

Nelco end mills are precision ground all over—from shank to cutting edge.

174 different end mills—diameters from ⅛" to 3"—2, 3, 4, or 6 flutes—straight or taper shank—a tool for every application!
Specific cutting angles are engineered for each size and series of tools assuring smooth, prolonged performance on all materials.

Send today for the new Nelco catalog — over 700 tools, 700 ways to better production at less cost.

NELCO TOOLS

For that EXTRA Edge in Production!

NELCO TOOL COMPANY, INC., MANCHESTER, CONNECTICUT

STOCK OF OVER 3000 STANDARD TOOLS!
Obtain impartial High Speed Steel, Carbide and Carbide Tipped tooling recommendations from your Brown & Sharpe-NELCO Distributor.

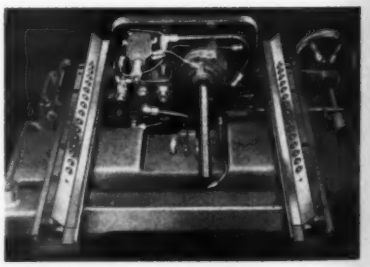
CIRCLE INFORM-A-GRAM KEY NO. 110

NEW GRINDERS OFFER HEAT REDUCTION AND BALL BEARING WAYS

A new line of hydraulically-operated precision surface grinders are being manufactured in the three most wanted sizes: 8" x 24" x 12", 12" x 18" x 12", and 12" x 24" x 12".

These "Hydrobrasive" grinders offered by the Abrasive Machine Tool Company use two hydraulic cylinder rams for the table so that while one ram is under pressure, the other is cooling. The hydraulic system operates on 200 lbs pressure, has a normal temperature rise of only 20°F, and can be removed easily for maintenance on its own casters.

The 450-lb head, spindle, and motor assembly is dynetrically balanced after assembly, and is also balanced on the elevating screw to eliminate binding on the column ways. Column dimensions offer a standard clearance of 12" under a 12" wheel, and an 18" clearance can be supplied, Figure 1.



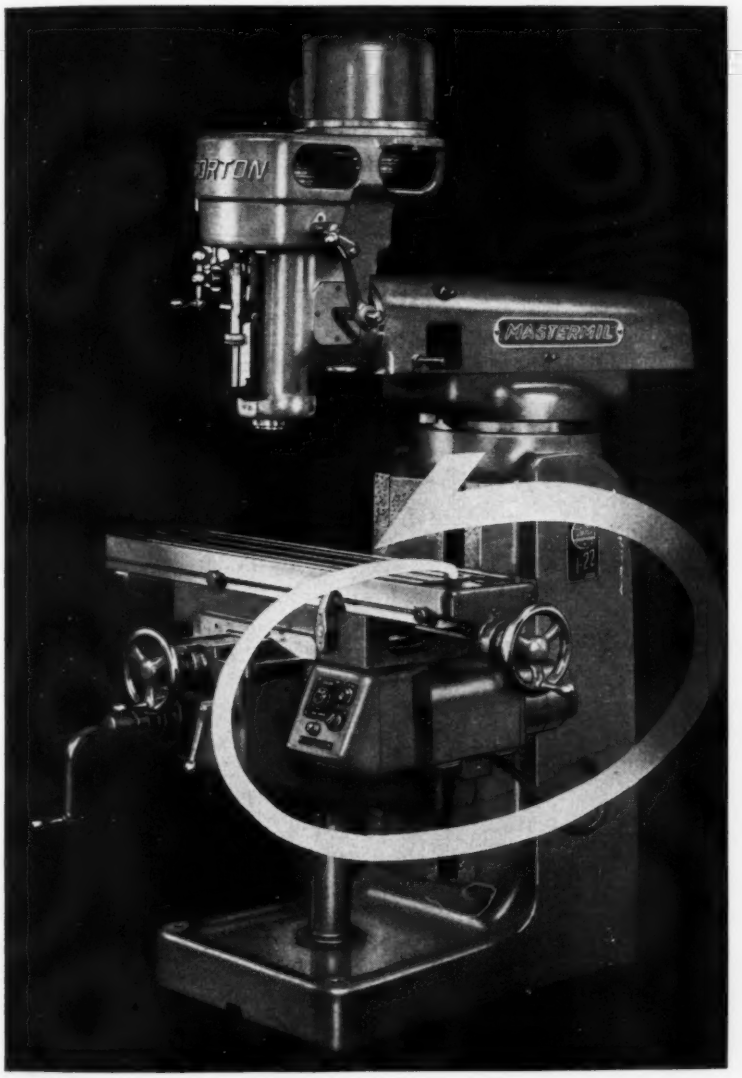
Other innovations include preloaded ¾" ball bearings on hardened steel saddle ways, Figure 2; precision-ground cross feed screw with backlash eliminator; hydraulically-operated rapid saddle traverse for wheel dressing; and all controls grouped conveniently and mechanically interlocked for safety.

For the first time — on any milling machine

ELECTRONIC DYNA-DRIVE

REGISTERED TRADE MARK

THE "TORQUE-THINKING" TABLE FEED



Yours
EXCLUSIVELY
with

GORTON MASTERMIL

It "feels"... as it feeds

● The exclusive Gorton Dyna-Drive® Table Feed unit "thinks while it works." It automatically adjusts to provide the exact amount of torque required. This electronic "brain" compensates during the cutting operation for small variation in density, hardness and molecular structure of the material being machined. Results are exceptionally fine finish and prolonged cutter life.

The Gorton Mastermil is precision-built throughout, simple, rugged with the finest milling head of any machine in its class. Ram adjusts in and out. Turret revolves and spindle swivels 90° left or right.

Learn more about this remarkable machine by writing for bulletin 2699A—209

GORTON

SINCE 1893

GEORGE GORTON MACHINE CO.

1209 RACINE STREET • RACINE, WISCONSIN

Tracer-Controlled Pantographs, Duplicators — standard and special . . . Horizontal and Vertical Mills, Swiss-Type Screw Machines, Tool Grinders, Small Tools and Accessories.

A7-1003-1P

CIRCLE INFORM-A-GRAM KEY NO. 111

WHAT ABOUT OVERTIME COSTS?

—12 QUESTIONS AND ANSWERS

by Paul Lockwood
Richmond, California

OVERTIME COSTS ARE A PROBLEM to shop management. They must be calculated correctly to comply with the Federal Wage-Hour Law . . . they must be controlled to keep production costs at a competitive level . . . they must be explained to employees so there is no decline in shop morale.

Because of this, shop management is taking a critical look at the overtime costs. It is checking actual overtime costs and comparing them with past records. Management is seeking the answers to the following questions:

1. How can shop management determine where overtime costs are out of line?

Before any executive decision can be made to reduce the overtime costs, they first must be known. Here is a plan to provide the facts to study overtime costs in your machine shop:

- Segregate payroll costs by departments on a regular-time and overtime basis.
- Compare overtime costs by departments to spot departmental problems.
- Observe employee performance in the various departments to judge the necessity for overtime work.
- Question supervisors about ways overtime can be reduced or controlled.
- Check overtime costs with the Federal Wage-Hour Law to be sure it is being computed correctly.

2. What is the best method for computing overtime wages?

The law requires that all employees be paid a minimum of $1.00/hr and one and one-half times the regular rate for all hours worked beyond 40 a week.

3. What is the "regular rate" of pay?

This is defined as all remuneration for employment paid to, or on behalf of, your employee. It does not, however, include these statutory exemptions:

- Gifts paid at Christmas or on some other special occasion.
- Payments made for periods when no work is performed such as a vacation, holiday, sick leave, or when there is a lack of work.
- Any contributions you make to a pension plan, retirement, old age, life, accident, or health insurance program.
- Any premium pay for work above your regular weekly or daily standards.
- Premium pay for work on Saturdays, Sundays, holidays, regular days of rest, or for the sixth or seventh day of the week.
- Any extra compensation for work outside the regular workday or workweek that is

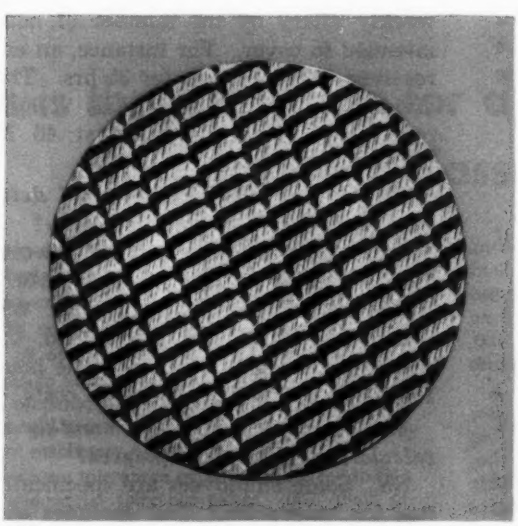
. . . Continued on page 114

THE MOST EXCITING FILE NEWS IN YEARS!

Nicholson announces the new

MAGICUT ALL-PURPOSE MACHINIST'S FILE

with exclusive Penetrating Planer Type Teeth that rough... then smooth all metals in one stroke!



⬆ This is a close-up (enlarged) of the most efficient All-Purpose Machinist's file you can use. It's available *now* through your Industrial Distributor.

⬅ Note the unique pattern of narrow chip breakers created by steep-angled serrations. This *maximum* cutting surface design gives fast, deep penetration on all metals.

When it comes to file news, it's Nicholson that makes it! The news now is the Magicut—a great new Machinist's file.

The All-Purpose Magicut has a new kind of teeth—Penetrating Planer Type—to rough and smooth all industrial metals in one operation. This new tooth structure, created by Nicholson research, is *super*-efficient.

You'll like the exceptional versatility of the Magicut. You can use it on dense metals like brass and bronze... on other metals like annealed tool steel and malleable iron. The Magicut is an All-Purpose Machinist's file for everything from soft aluminum and lead to stainless steel. It comes in Flat, Half Round and Square shapes in 8-, 10-, 12- and 14-inch lengths.

Created by Nicholson researchers, made by Nicholson craftsmen, sold in Nicholson or Black Diamond brands, the Magicut is the most exciting file news in years!

In keeping with his policy of bringing you the newest and finest in equipment and tools, your Industrial Distributor now has the new Magicut file. Ask his representative to show it to you.

NICHOLSON U.S.A. **NICHOLSON FILE CO., 27 ACORN STREET, PROVIDENCE, RHODE ISLAND** BLACK DIAMOND U.S.A.
(In Canada: Nicholson File Company of Canada Ltd., Port Hope, Ontario)

NICHOLSON and BLACK DIAMOND FILES

A FILE FOR EVERY PURPOSE

CIRCLE INFORM-A-GRAM KEY NO. 113

. . . Costs from page 112

not covered in the employment contract or in a collective bargaining agreement.

4. What is a workweek?

You can establish any workweek you want for your shop: It need not conform with the calendar week (Sunday through Saturday); it may begin at any hour of any day. According to law, a "workweek" is a regular recurring period of 168 hrs. Thus, any seven consecutive 24-hr periods would be considered a workweek for the Federal Wage-Hour Law provisions.

5. Can a machine shop average hours for two weeks in a regular pay period?

No. The regular workweek is the standard. An employee working 30 hrs one week and 50 hrs the next week in a two week pay period should be paid as follows:

1st week	30 hrs at regular rate
2nd week	40 hrs at regular rate, plus 10 hrs at one and one-half times the regular rate.

6. How should overtime be calculated when employees are paid at an hourly rate?

The simplest way is to multiply all hours worked at the regular rate. Then, take all hours over 40 and multiply them by one-half the regular rate. For instance, at $1.60 for the regular hourly rate and 50 hrs worked, the figures would be:

50 hrs at $1.60	$80.00
10 hrs at .80	8.00
	$88.00

You get the same answer by computing your overtime with this method:

40 hrs at $1.60	$64.00
10 hrs at $2.40	24.00
	$88.00

There is a difference between the $8 in the first method and the $24 in the second method. The first method separates only actual overtime costs, while the second method includes the regular wages plus overtime costs for the overtime period.

7. How does a bonus plan change this?

Assume the same facts in this as before plus a $5.00 bonus for the week. You would calculate this as follows:

50 hrs at $1.60	$80.00
Bonus of $5.00	5.00
	$85.00

Divide the total wages ($85.00) by the total hours (50) and you have a rate of $1.70/hr.

50 hrs at $1.70	$85.00
10 hrs at .85	8.50
	$93.50

8. What about employees on a piecework basis?

You compute the regular rate of pay in these cases by adding together all of his weekly earnings from piecework rates, waiting time wages, and production bonuses. This amount is then divided by the number of hours worked to determine his regular rate. This is then handled the same as any other wages to determine the overtime wages.

For instance,

Piecework pay	$70.00
Waiting time wages	15.00
Production bonus	5.00
	$90.00

Divide earned wages ($90.00) by number of hours worked (45, in this instance) to determine regular rate ($2.00).

45 hrs at $2.00	$90.00
5 hrs at $1.00	5.00
	$95.00

9. How is overtime calculated for employees hired at a weekly rate?

You would compute this by dividing the weekly salary by the number of hours it is intended to cover. For instance, an employee received $70.00 a week for 35 hrs. The hours divided into the salary equals $2.00/hr. He receives $2.00/hr for the first 40 hrs and $3.00/hr for all hours over 40.

10. How is the "regular rate" determined for employees on a monthly salary?

This needs to be reduced to a work week. This is done by multiplying the monthly salary by 12 and dividing this total by 52. When this weekly rate has been determined, the same procedure is used to arrive at the hourly rate for use in calculating overtime costs.

11. Does this weekly and monthly overtime calculation cover all employees?

No. Some employees are specifically qualified for exemption. This includes executive, administrative, or supervisory workers in the shop.

12. What about salaried employees who work irregular hours?

Some employees are hired at a certain salary per week with the understanding that this is to cover all hours he works. When this employee works different hours each week, his regular rate of pay will change each week.

You calculate this by dividing his weekly salary by the number of hours worked. This gives you his regular rate for each week and then the usual overtime calculations are used for all hours over 40 in one week. end

This is the scrap pile for a run of 400 Class 5 tolerance screws

Four minutes' worth of on-the-spot inspection on a Kodak Contour Projector tells operators how five critical tolerances of their work measure with company standards. Result—a reject rate of ¼ of 1 per cent.

The Chicago Screw Company, Division of Standard Screw Company, produces threads to Class 3, 4, and 5 tolerances—fine or better—for automotive, aircraft, and farm machinery makers.

Screws have tolerances of .005″ lead error to fit a .002″ dimensional tolerance gauge; .002″ pitch diameter tolerance; and 15-minute tolerances on flank pitch.

Kodak Contour Projectors make it easy for operators to run rapid routine quality checks. Highly trained inspectors check operators' quality control reports and spot-check production.

When a tolerance question comes up, the accurate answer again comes from a Kodak Contour Projector. In about four minutes, operators check out a thread completely, including pitch diameter, lead error, pitch, depth, and helix angle to tolerances well within .001″. As a result, *the reject rate in the firm's threading division is down to an average of ¼ of 1 per cent.*

A Kodak Contour Projector can be the way for *you* to keep tolerances profitably tight on mass production runs. It can also be the way for you to improve inspection accuracy and speed—while lowering your inspection costs. Send for the booklet "Projection Gaging with Kodak Contour Projectors." Write to:

Kodak Contour Projector, Model 14-2A—a versatile, precision measuring projector for toolroom or production line.

Apparatus and Optical Division
EASTMAN KODAK COMPANY, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

Kodak

CIRCLE INFORM-A-GRAM KEY NO. 115

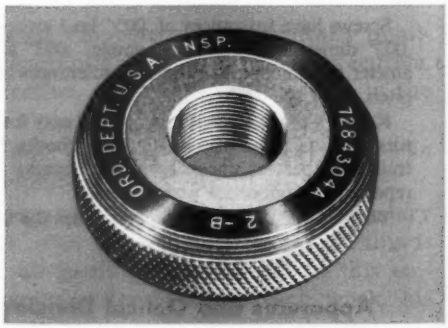
Does *Craftsmanship* Still Live?

At The Pipe Machinery Co., the people who develop, produce and ship gages to you feel you deserve craftsmanship when you order our gages.

Because of this dedicated pride of theirs, they do some remarkable things freely—willingly. The plant, their machines, their tools, are in apple pie order. They want it that way. They do better work—easier—that way.

Many times they do little extras, that prove to us that they are as interested in giving you service as they are in their own pride of workmanship. Yes, craftsmanship lives here.

If you are going to be in the Cleveland area soon, drop in and see us.



THE PIPE MACHINERY COMPANY

29102 Lakeland Blvd. • Wickliffe, Ohio

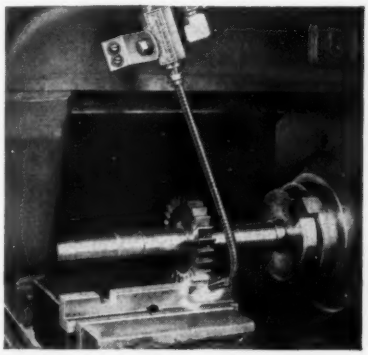
Greater Cleveland

CIRCLE INFORM-A-GRAM KEY NO. 116

MIST COOLING MEANS LONGER TOOL LIFE

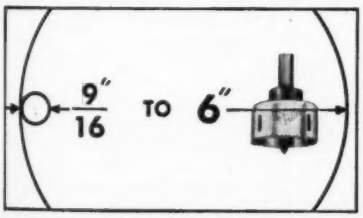
Recent reports by metal cutting specialists indicate that mist cooling produces important benefits in longer tool life, improved work quality and reduced heat distortion of work on a wide variety of operations. Mist cooling systems like the MILFORD Atom-Lube combine compressed air and cutting fluid, producing a fine mist to remove heat from the tool's cutting edge and from the work. This is the major factor in improved tool performance.

The MILFORD Atom-Lube system is a ruggedly designed unit made specially for tough industrial applications. Adaptable to almost any piece of equipment, its range of applications is only limited by the industrial user's imagination. For more complete information about making these savings available for your operations, write to MILFORD . . . a pioneer in mist cooling.

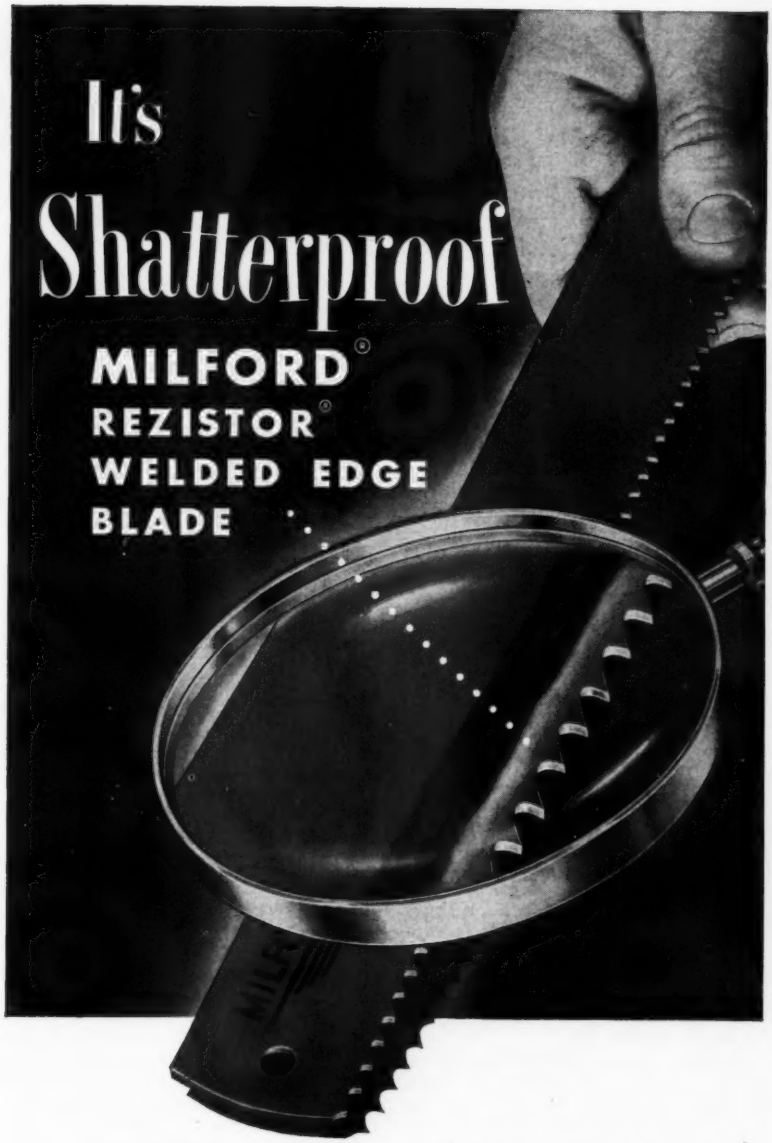


MILFORD Distributors now offering Hole Saw Line

Industrial distributors who carry MILFORD Hack and Band Saw Blades are now stocking the new MILFORD Shatterproof High Speed Steel Hole Saws. Available in a complete diameter range from



9/16" to 6", these welded-edge blades cut clean, round holes in practically any machinable metal or non-metallic. Many manufacturers have investigated their present hole cutting methods, particularly in large diameters, and after comparative tests have selected MILFORD Hole Saws. A new convenience for industrial maintenance work are MILFORD's sturdy metal Hole Saw Kits for popular pipe tap sizes and pipe entrance sizes. Local MILFORD distributors are ready to demonstrate these plumbers' and electricians' Hole Saw Kits, as well as other MILFORD metal cutting saws, to industrial customers throughout the country.



Industry's first choice in *Shatterproof Power Hack Saw Blades,* the REZISTOR WELDED EDGE combines the maximum in safety and metal cutting performance. Three-ply construction provides a cutting edge of high speed steel with teeth as hard, sharp and long-wearing as any all-hard blade . . . and this edge is *WELDED* and *HOT ROLLED* into a back of tough resilient alloy for superior strength and shatterproof qualities.

MILFORD

BUY FROM YOUR MILFORD DISTRIBUTOR . . . a local businessman who stocks the tools and equipment you need. You'll SAVE TIME, CUT BUYING COSTS and REDUCE INVENTORIES.

THE HENRY G. THOMPSON & SON COMPANY • NEW HAVEN 5, CONNECTICUT

Saw Blade Specialists for Over 80 Years

HACK SAW AND BAND SAW BLADES • HOLE SAWS • GROUND FLAT STOCK

CIRCLE INFORM-A-GRAM KEY NO. 117

Special Machines

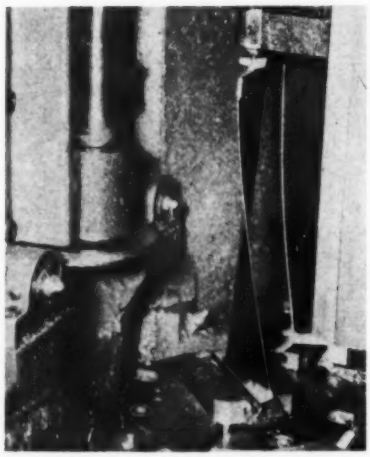
PROFILE MILLING 8 JET ENGINE BLADES SIMULTANEOUSLY

High-production, precision machining of steel and titanium jet engine blades is now possible with a new 8-station, automatic shaping or milling machine developed for the Air Force.

In simulated production runs, 8 blades (10" long and 3" wide) have been profile machined in 90 min. Fully loaded with 32 blades, the machine runs for 6 hrs without manual attention other than to remove finished blades from the unloading magazine.

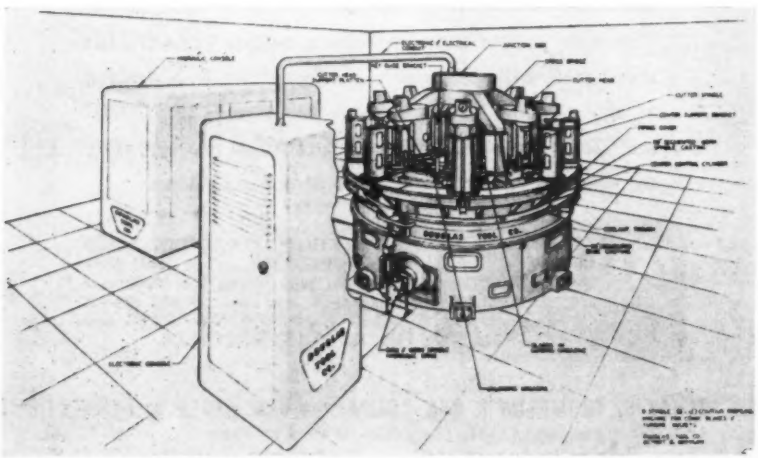
Each of the 8 heads involves control of three specific movements: hydraulic downfeed of the cutters; hydraulic drive of the milling head; and rotation of the work-holding chuck. Coordination of these three movements is controlled by an electrical computer. The computer picks up its signals from a master cam, which is an exact enlarged version of the actual blade being milled. Feed rate of the cutter is maintained constant in relation to the blade. As blade contour changes and it becomes wider, the work chuck rotation slows automatically. This maintains a constant surface speed and chip load at all times. Chuck rotation increases at the leading and trailing edges of the blade to compensate for change in dwell time.

Contour milled blades require no grinding, polishing being sufficient. Douglas Hi-Helix carbide contour milling cutters provide excellent finish and long tool life. Finish ranges from 75-90 microinches. Up to 0.100" of stock is removed while milling the blades. Cutters are 3.75" dia and up to 3/32" can be removed by sharpening.



Finished titanium blade ready to be released from chuck and transferred to the unloading magazine. Cutter is retracted and moving upward to be ready for next blade. High helix angle on cutter directs major thrust of cutting force downward to prevent deflection of blade.

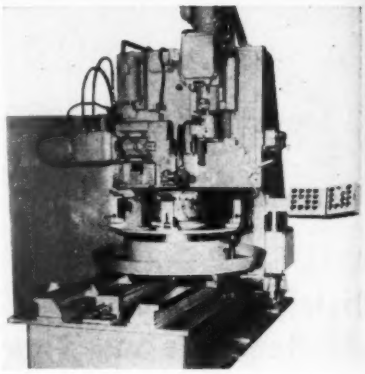
Another unusual feature of this machine, built by the Douglas Tool Company, is that cutters do not have to be matched to exact diameters. After checking diameters, dial settings on an electrical control panel automatically compensate for any difference in size up to 0.080".



AUTOMATIC INDEXING MACHINE FEATURES 2-SPINDLE DRILLING UNIT

This special automatic indexing machine, recently produced for a prominent aircraft engine manufacturer by the Hoefer Manufacturing Co., is built around two Hartford Special Machinery Co. automatic drill units.

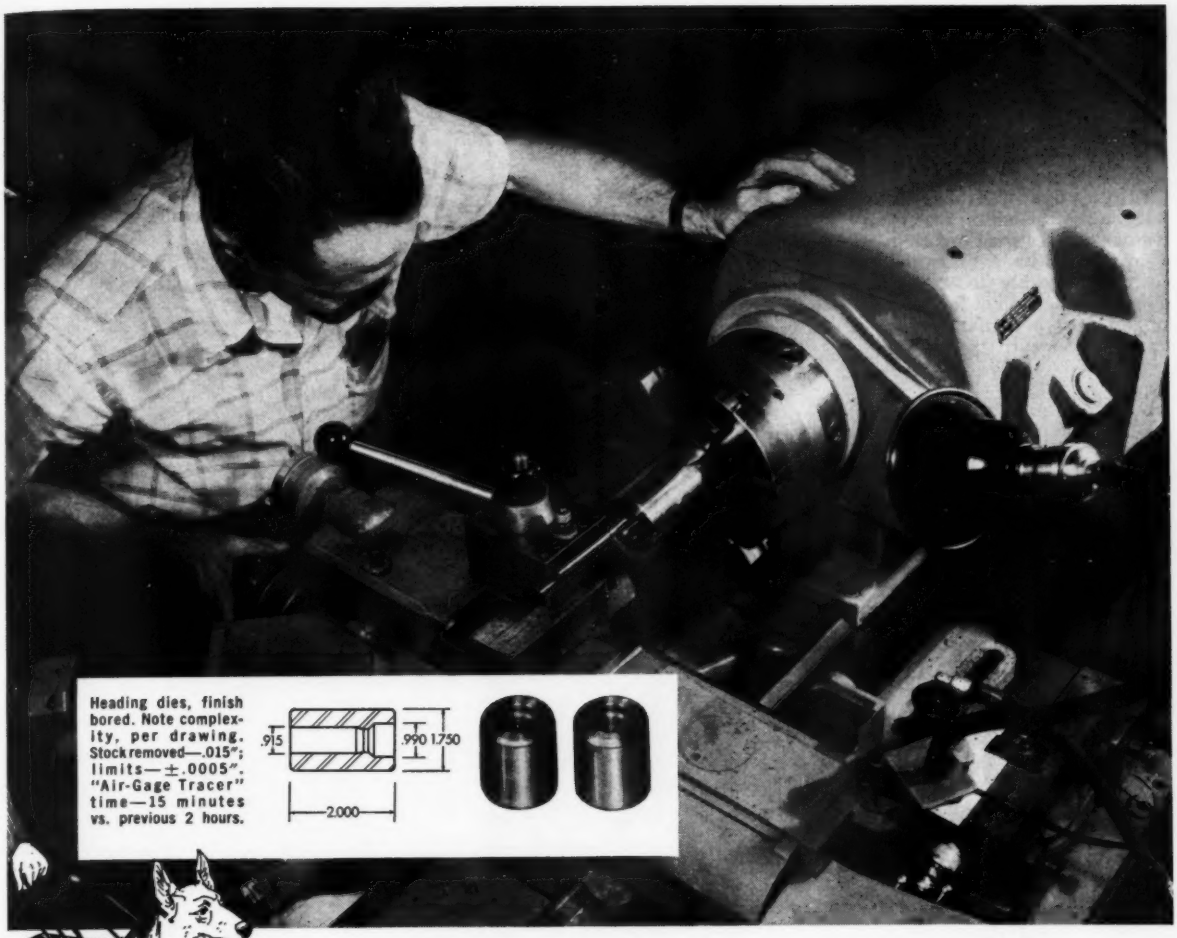
Mounted on the horizontal Hartford unit is a two spindle offset drill head which drills, spotfaces, reams and hollow mills a group of bosses, two at a time, in the horizontal plane. Since this group of bosses has two different levels, the Hartford unit automatically raises for the insertion of a spacer after the lower level of bosses is completed, then the unit is again lowered, lining up with the upper level of bosses, for the completion of the operation.



The operations are accomplished in three passes. The first pass, drill and spotface, is followed by a tool change, after which the cycle is repeated for the reaming operation. Again the tools are changed and the cycle repeated for the hollow milling operation.

The sealed, pumpless hydraulic system employed within the Hartford units provides the flexibility required for this job. Controls conveniently grouped at the nose of the unit permit quick setting of rapid approach, length of feed to positive depth, and feed rate to suit the three varied operations performed by this equipment.

One additional cycle is made with the vertical unit drilling two 0.078" cross holes through the bosses at right angles to the horizontally drilled holes. The work table is then moved forward for the removal of the piece, leaving the machine ready for a new piece.


Heading dies, finish bored. Note complexity, per drawing. Stock removed—.015"; limits—±.0005". "Air-Gage Tracer" time—15 minutes vs. previous 2 hours.
.915
.990
1.750
2.000

"Seeing-Eye Tool" for close-limit blind boring

Want to take the guesswork out of close-limit blind boring? And with it that unhappy combination of low production and high spoilage? How? Let the Monarch "Air-Gage Tracer" be your lathe operator's seeing-eye.

With this device you're as certain of meeting tolerances in boring as in turning or facing. Your template is precise. Your tracer stylus, operating on a pressure of only 5-6 ozs., converts changes in template contour to corresponding tool positions within a few thousandths of a second. You hold size with certainty piece after piece—the template sees to that. Up goes production anywhere from 10 to 90%, accuracy and finish are improved—all accomplished with the most accurate duplicating device yet designed.

The "Air-Gage Tracer" can be factory-applied to most Monarch lathes. Prove *your* vision by requesting full information in the form of our complete booklet No. 2608 . . . . . ***The Monarch Machine Tool Company, Sidney, Ohio.***

Monarch
ACCURACY • ECONOMY • LONG LIFE
TURNING MACHINES
FOR A BETTER TURN FASTER . . . TURN TO MONARCH

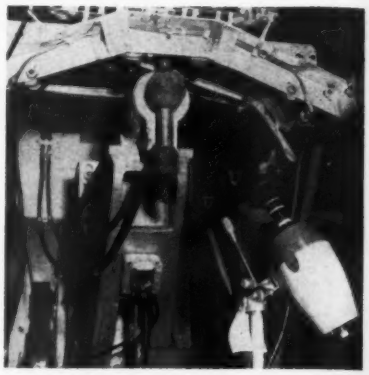
CIRCLE INFORM-A-GRAM KEY NO. 119

TV System Assists Quality Control in Airframe Spotwelding

Closed-circuit television has replaced the human eye in watching structural spotwelding on the underside of large aluminum panels of the KC-135 jet tanker-transport skins.

At the Ryan Aeronautical Company, a small General Precision Laboratory TV camera focused on the welds transmits a magnified report via coaxial cable to a 17" monitor screen on the side of the welder. No longer must a human "watcher" be stationed beneath the welding platform to assure the highest quality; at a glance, the single operator now sees the condition of both top and bottom welds.

Because of the heat and pressure necessary to accomplish spotwelds, the copper alloy welding tips soon pick up aluminum from the clad — an outer layer of pure aluminum which covers the harder alloy core. Since clad is the protective coating which prevents corrosion of the metal, it is important that this pick-up be kept to a minimum and both welding electrodes cleaned when the deposit becomes noticeable. Through the use of television, the welder now can stop the moment the first sign of electrode pick-up appears on the screen.



With the new TV control setup at Ryan, the spotwelder easily keeps track of quality of welds on underside of aluminum panel by checking enlarged 5½" spots on TV screen at rear.

The TV camera is set up to move on an arc to coincide with the longitudinal and crosswide motions of the panel. Remotely powered, it is operated by a flip switch and follows the line of welding in any direction. Two lenses provide either detailed close-ups of each spotweld or wide angle views which enable the operator to remove his work from the narrow clearance between the welding tips without bumping. A combination of fluorescent and incandescent floods are used to assure proper lighting without reflection from the aluminum panels or spotwelds.

use your head*

use COGSDILL BURRAWAY tools

*Any work head will accommodate this highly versatile deburring and chamfering tool!

Whatever your hole deburring problem . . . the clean, quick action of the Cogsdill BurrAway Tool, with its spring-loaded double-edged cutter blade, completely deburrs both faces around any hole or series of holes in line in one rapid in-and-out operation.

We will be pleased to have our local representative show you how this versatile tool can be used successfully with your particular equipment.

Cogsdill
TOOL PRODUCTS, INC.
12980 W. Eight Mile Road, Oak Park 37, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 120

BUY U.S. SAVINGS BONDS

ALL THE **PRODUCTION** YOU'LL *EVER* WANT—

ALL THE **PRECISION** YOU'LL *EVER* NEED

RIGIDITY and STAMINA TOO!

Generates spur gears, spiral gears, bevel gears, face gears, worm gears, worms, spline shafts, gear sectors and pinions. 12 hob speeds, from 109 to 1259 R.P.M. Helix leads from .800" to 130". Generates gears with as few as 3, or as many as 650 teeth. Speed, feed, and indexing, each can be selected independently. Capacity from .050" to 6" O.D. of gear blank depending on gear characteristics. Free Bulletin No. 2544 provides full information.

2544

It's the

Hamilton

PRECISION SMALL-GEAR HOBBING MACHINE

THE HAMILTON TOOL COMPANY • 832 SOUTH NINTH STREET • HAMILTON, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 121

CUTTING COSTS WITH A *BAND*

by Frank Foulis
Chief Tool Designer
MIEHLE PRINTING PRESS COMPANY
Chicago, Illinois

Ingenious fixturing on band machine cuts operating costs an average 58% over milling. . . Set-up time drops 75% . . . Single band machine replaces two milling machines. . . Slots and cuts 275 different parts.

BY USING MANY INGENIOUS FIXTURING DEVICES, our plant has transferred the heavy slotting and cutting loads of two milling machines to a single band sawing machine. The DoAll band machine slots and cuts 275 different parts faster and without production bottlenecks.

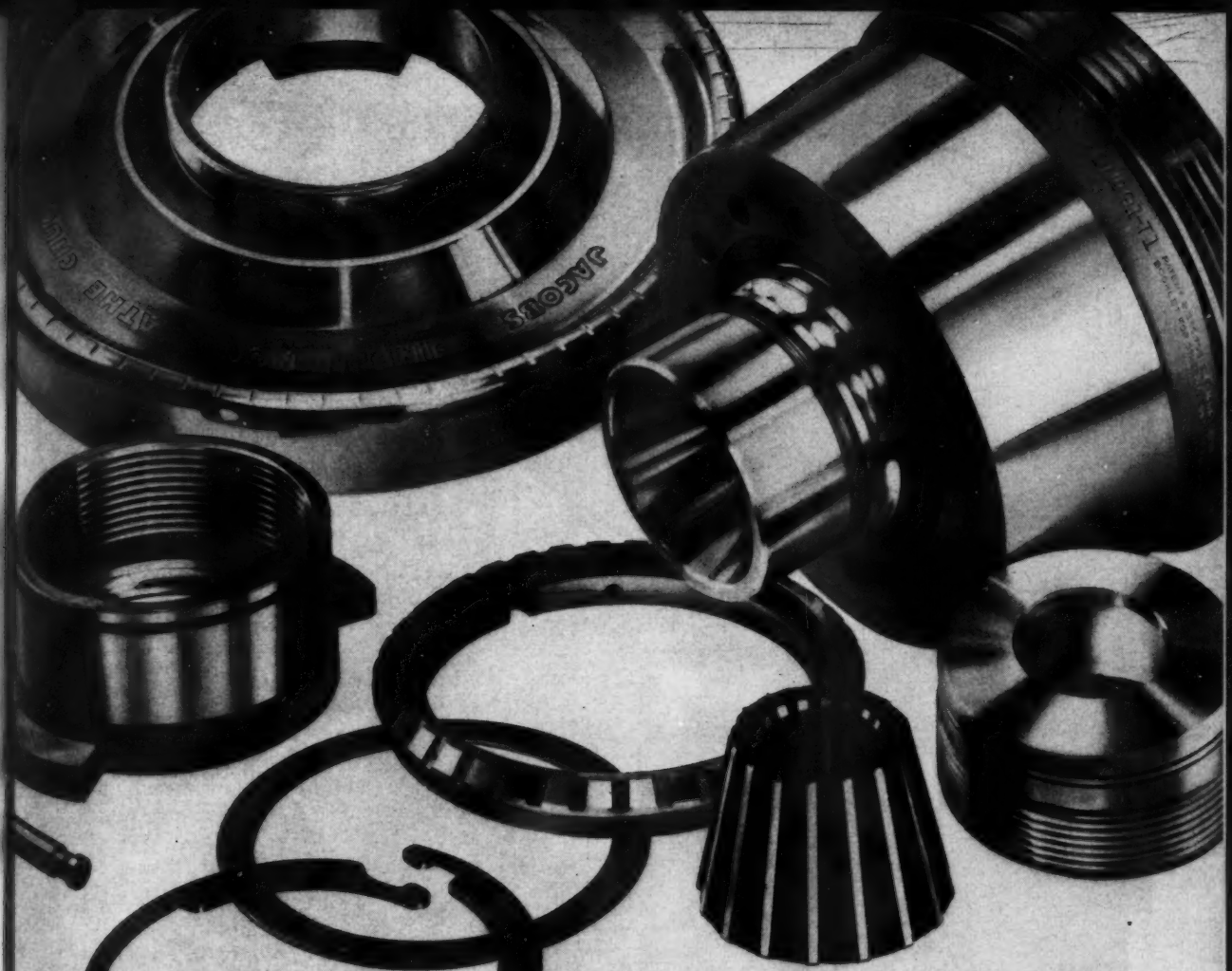
A Miehle-conducted audit of cutting time on 15 typical parts shows a 58% saving for band machining over milling. Since the Contourmatic band machine does not need clamp-down fixturing, an average saving of about 75% in milling machine set-up time has been registered. Downward pressure of the swift, continuous saw blade holds parts firmly to the simplest of fixtures, without complicated clamping.

More than 75 fixtures have been designed by Miehle to hold a variety of parts on the hydraulically-operated band machine table. Most of the work performed is slotting. On some parts, where sawed surfaces must mate, a further light machining cut is taken for a smooth surface. Various size levers for printing presses, for example, are slotted to facilitate fastening on shafts; cams are split for ease of assembly and for simple maintenance removal in case of wear.

Specifically, slotting one part on a milling machine formerly took 20 min cutting time. With band machining, the job now is timed at 9 min.

. . . *Continued on page 124*

Band saw operator can slot this bearing in ½ min, using special post mounting fixture. The job formerly took 1½ min on a milling machine equipped with a slitting saw.

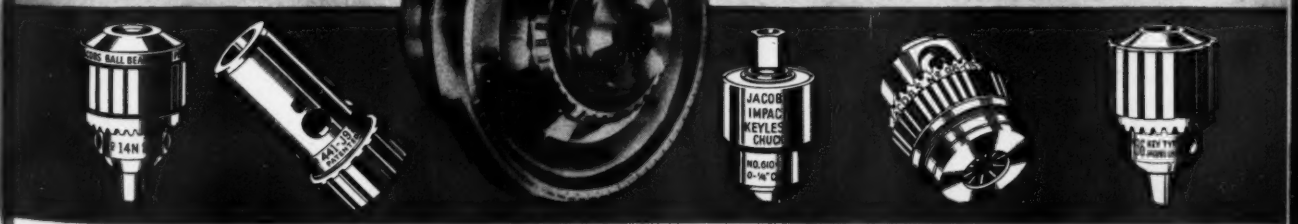


Jacobs
CHUCKS

Accuracy in performance is achieved by accuracy in production of every component part.

Jacobs and your industrial supply distributor are ready to deliver the chucks you need and the service you deserve. First in chucks . . . first in service.

The Jacobs Manufacturing Company
West Hartford, Connecticut



The Jacobs Ball Bearing Super Chuck for heavy duty and precision industrial use.

The Jacobs Rubber-Flex® Tap Chuck designed for tapping heads and impact tools.

The Jacobs Model 91 Spindle Nose Collet Chuck for tool room and engine lathes.

The Jacobs Impact Keyless Chuck especially designed for the aircraft industry.

The Jacobs Model 96 Collet Chuck for grinding machines, millers and jig-borers.

The Jacobs Plain Bearing Chuck for drill presses, portable electric and air tools.

. . . Continued from page 122

It takes 1 min to machine a cast flange part on band machine. On a milling machine, 45 min went to set-up time and 3¼ min to machine each piece.

A simple clamp-type fixture is used to split a cast iron cam part on a band machine. This was a difficult task for a milling machine.

In one job which often bottlenecked the machining line, a long, lengthwise slot was cut on a 50-lb part with a circular saw on a milling machine. The entire slot could not be cut in a single pass. One half the slot was cut, then the workpiece had to be re-fixtured for the second half of the cut. Alignment of the two mating cuts had to be perfect. Setup on the mill for this job was complicated and time consuming. Manual handling of the heavy part was excessive. Sometimes, the saw was stopped dead in the cut, shattering and creating a hazard. The mill's arbor might bend — or keyways might be grooved. Now, the long cut is taken in one pass on the band machine, in a fraction of the time formerly required.

In another job, a bearing is slotted in ½ min on the band machine. On a milling machine equipped with slitting saw, the same job took 1½ min.

Only 1 min of cutting time is needed to band machine a cast flange part. On a milling machine, cutting took 3¼ min and setup about 45 min. Setup on the band machine with a simple post mounting fixture takes a small fraction of the time.

Slotting a heavy cam lever by milling once took many minutes of cutting time. On the DoAll, it takes 1.35 min/part.

For most of Miehle's slotting work, the hydraulic feed table of the band machine is equipped with a flat base plate, on which many plate-and-post fixtures are mounted, for a diversity of parts. Posts of fixtures are vertical or inclined for various angles of slotting.

Another troublesome job accelerated by band machining is cutting sections from flat steel rings. A raised section of the flat, simple fixture holds the bore of the ring. The plate-like fixture has a channel to guide the saw blade. "Flag" stops on the fixture can be dropped to permit cutting sections to desired lengths. Formerly, milling machines with circular saws did this tedious and time-consuming work.

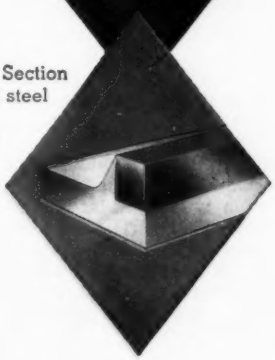
Miehle now band machines hard rubber sections that serve as rollers for its line of printing presses. Previously, the rollers were purchased as individual pieces at a cost of $1.75 each. Today, Miehle band saws its own rollers from 36″ lengths of rubber, costing $11 per length. Thirty rollers are cut from each 36″ length. Thus, 30 rollers which once cost $52.50 now cost $11, plus minimal costs of band machining.

end

Some of Miehle Printing Press Co.'s band machine fixtures are shown on rack. Most of them are mounted on a single plate. The fixture held by worker is used to split rings into different sized pieces, depending on where flag stops are dropped into place.

Photograph courtesy of the Ready Machine Tool & Die Company, Inc., Connersville, Ind. shows Ohio Knife Co. Composite Die Sections on a blank and pierce die for a 4' x 6' refrigerator inner food compartment.

there's a NEW way to build your dies



OK Die Section shows tool steel clad to mild steel backing.

it saves you time and money

You simply order from our large stock of Composite Die Sections. They are cut to your required length or in bars 125" long. There are eleven standard cross sections with both wide and narrow lands available.

You buy them at a price far below what it's costing you to make them yourself.

You receive them with cutting or forming edge already hardened, machined and ground. The soft steel backing, to which our specially hardened tool steel is clad, can be drilled quickly and economically for dowel and screw holes. Adjustments for wear are equally simple.

Hundreds of companies who have switched to OK Composite Die Sections available for Cutting, Trimming and Forming Dies, report great time and money savings, plus longer die life. For new bulletin on OK Composite Die Sections and Clad Aluminum Bronze Wear Plates, write Dept. 47-LL.

Manufacturers
for the Metal Working Industry of:

Composite Die Sections . Bronze Ways . Wear Strips
Shear Blades . Slitter Knives . Work-Rest Blades
Cut-off Blades . Hardened Ways . Hardened Spacers

THE OHIO KNIFE CO.

CINCINNATI 23, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 125

Call Pioneer now...

Why worry about where to find competent designers and engineers of dies, fixtures, tools and gages.

Pioneer has them for you.

Our highly skilled tool designers and engineers are the permanent solution to engineering overloads in many tool and process engineering departments like your own.

They will be ready to go to work *when and as you need them.* Eliminate worry about temporary overloads and excessive payrolls. Call Pioneer headquarters now.

SINCE 1931 **Pioneer ENGINEERING & MANUFACTURING CO., INC.**
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INDUSTRIAL ENGINEERS, CONSULTANTS & DESIGNERS
BRANCH OFFICES IN DAYTON, OHIO, WASHINGTON, D. C. and TORONTO, ONT., CAN.

CIRCLE INFORM-A-GRAM KEY NO. 126

COURSE ON SMALL-PLANT AUTOMATION

Editors Watson Nordquist and William Hoffman of TOOLING & PRODUCTION are scheduled as guest lecturers for a forthcoming one-week course in "Automation for Small Plants".

Moderated by Richard Felver of the Carnegie Institute of Technology faculty, this course is designed to show how to automate your small plant and cut production costs to the bone. Subjects will include economic analysis and feasibility, advance planning, programming, effects on labor, selling automation to employees, equipment and methods, and feedback controls.

Mr. Nordquist will concentrate on the maximum use of standard, low-cost multi-purpose machine components and will lead a discussion of actual examples of their application. The basic theory and application of pneumatic and hydraulic circuits to the mechanization of common production operations will be presented by Mr. Hoffman. Another session will be devoted to automatic handling equipment, led by Paul Schneider of Schneider Industries, Inc.

This course, to be held at Pocano Manor, Pa., Sept. 16-20, has been organized by The National Institute of Management, Cleveland 14, Ohio, which specializes in training programs for progressive management.

SPECIAL ALLOY REPLACES CARBIDE WEAR TIP ON FILAMENT BENDING TOOL

Nihon Radio Co. has found that useful service life of bending tools for vacuum tube filament production is tripled when tools are tipped with WCR-100 alloy instead of tungsten carbide as had formerly been the practice. WCR-100 is an iron-base chromium-tungsten-boron material produced by Wall Colmonoy Corporation.

The bending tool is very similar in appearance to a small lathe tool. It is used for bending a fine, yet very stable wire used as the filament in vacuum tubes. The wear encountered is much like that found in a drawing die. The amount of wear on a tool tipped with tungsten carbide required that it be replaced after 10 days.

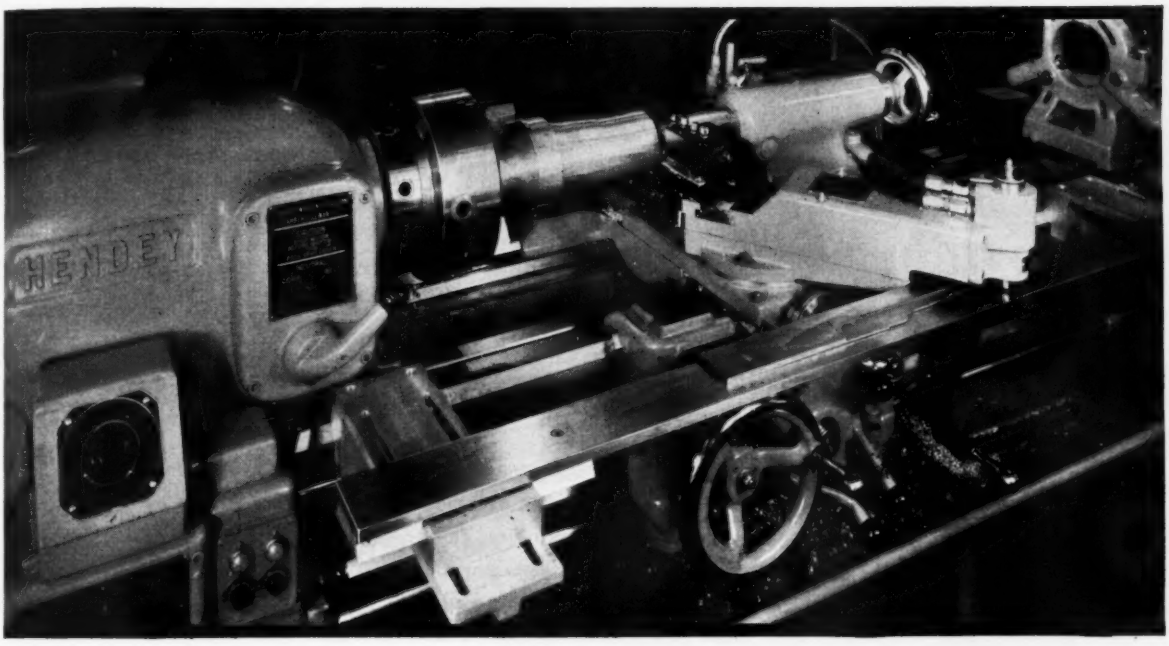
In an effort to improve service life, tool engineers at Nihon Radio tried applying a 1/8" thick coating of WCR-100 alloy welding rod to the tip of the tool in place of the tungsten carbide. With the new tip, the tool was used for 30 days before wear dictated replacement.

You get

top value per dollar

with a Hendey No. 2E lathe

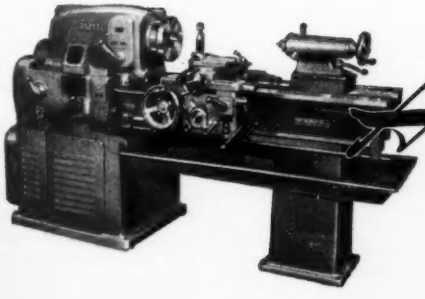
QUICK-CHANGE tracer attachment
CUTS CONTOUR TURNING COSTS!



The precision performance and fast, easy setup of the new hydraulic tracer control introduce previously unheard-of economy wherever three or more pieces are to be step-turned. Available as optional equipment, the new tracer is a packaged unit which simply replaces the standard compound . . . no drilling required. Mounts on front of lathe where the flat template stays clear of chips and coolant.

The Hendey No. 2E is widely known as the multi-feature lathe offering top value at moderate cost. Electronic drive with fingertip stepless speed control gives unmatched ease of precision production and makes the Hendey No. 2E ideal for hydraulic tracer control. Contact your Hendey dealer for details and specifications.

for precision with production, buy Hendey



Hendey machine division
BARBER-COLMAN COMPANY
97 Loomis St., Rockford, Illinois

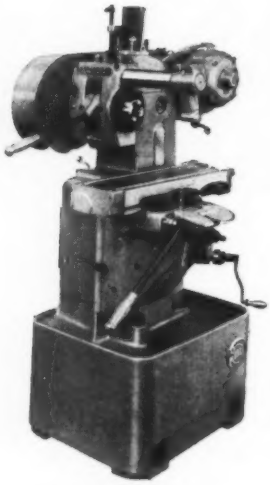
BARBER COLMAN

CIRCLE INFORM-A-GRAM KEY NO. 127

STURDY NICHOLS VERTICAL HEAD . . . has No. 40 Taper Spindle
NICHOLS SWIVEL VISE is a true precision unit equipped with verniers . . . only two of many available accessories.

NICHOLS
TOOL ROOM
MILLER

ACCURACY—SENSITIVITY—VERSATILITY



STANDARD MODEL—A precise, versatile Hand Miller with Rise and Fall spindle. Table size 6¾" x 21"

Gives the tool room what it demands—a compact, rugged miller with extreme accuracy and utmost flexibility. The Nichols TOOL ROOM MILLER is arranged for sensitive hand screw feed, has generous table surface—8½" x 30" with 19" longitudinal travel. Precision feed screws have oversize, *easy reading* micrometer dials. Large hand wheels provide element of "feel" so important in precision milling. Rise-and-Fall Spindle simplifies set-ups. Lever table feed, furnished *in addition to* screw feed, increases usefulness. Selective speed ranges up to 5000 RPM.

2 educational 16 mm sound color films available for free showing—send for descriptive letter and reservation form.

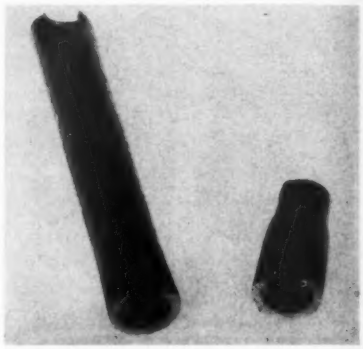
MANUFACTURED BY W. H. NICHOLS COMPANY
NATIONAL DISTRIBUTORS
THE ROBERT E. MORRIS COMPANY
REM SALES DIVISION
5007 FARMINGTON AVENUE • WEST HARTFORD 7, CONN.
CIRCLE INFORM-A-GRAM KEY NO. 128

SPINNING HOLES IN PIPE INCREASES WALL THICKNESS FOR TAPPING

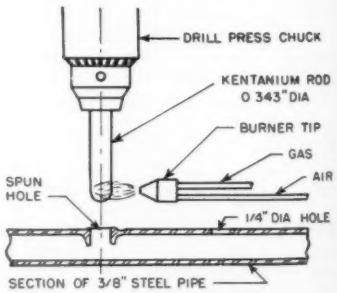
The threading of holes in the 1/16" wall of ⅜" pipe for ⅛" pipe fittings in a manner that would pass a gas appliance code pressure test, was a project taken on recently by Mission Appliance Corporation. Solution of the problem required thickening the wall around the hole to enable cutting more threads.

Since use of the thin-walled pipe reduced costs considerably as compared with heavier pipe, there was a strong incentive to find a way to use it in gas manifolds for water heaters.

A solution was found in spinning smaller holes to tapping size and thickness with a titanium carbide rod. A Kentanium rod (Grade K151A) made by Kennametal Inc. was selected because the operation requires high abrasion resistance at high temperature. These conditions also require resistance to oxidation and thermal shock while retaining high strength at operating temperatures.



Holes spun with a Kentanium rod in ⅜" steel pipe increased wall thickness enough to be tapped for threaded fittings, as shown by cutting through a tapped hole.



This method was used to spin holes in the 1/16" wall of ⅜" steel pipe.

A Kentanium rod of 0.343" dia and 3¼" long with ball nose ground on the end is flame heated to about 1200° F and turned at 2000 rpm in a drill press while being forced into ¼" punched holes in the pipe. In this operation the rod temperature

. . . *Continued on page 130*

Talking About Die Sets

with

Phil Marsilius

Executive Vice-President
The Producto Machine Co.

How to Select and Order a Catalog Die Set—Do you always order the die set you *really* need for the job...or do you overlook a specification which results in your having to "make do" with the set you ordered or lose time by having to re-order?

Once again, we feel that a simple and basic practice should be emphasized because our daily experiences show that even the most painstaking individual occasionally overlooks one or more factors in preparing to place an order.

Here is our suggested check-list for selecting and ordering a catalog die set:

1. Lay out the die. Allow sufficient area for feeding devices and auxiliary stock guides that may be required. Determine also what areas must be left clear for part ejection or scrap.

2. Determine type of set you need—rear two-pin, four-pin, center-pin, etc.—according to tolerances and construction of die.

3. Place layout on templates for the type of die set you have chosen. Select die area that best meets the limits established in Step 1.

4. Select material for die set—semi-steel, all-steel or combination—based on the die's strength requirements.

5. Select thicknesses of punch and die holder in line with strength requirements and allowable press shut height.

6. Determine length of guide-pin required*, based on length of stroke or ram clearance.

7. Determine type and length of bushing and material from which it should be made, based on accuracy, speed of operation and required life expectancy of die.

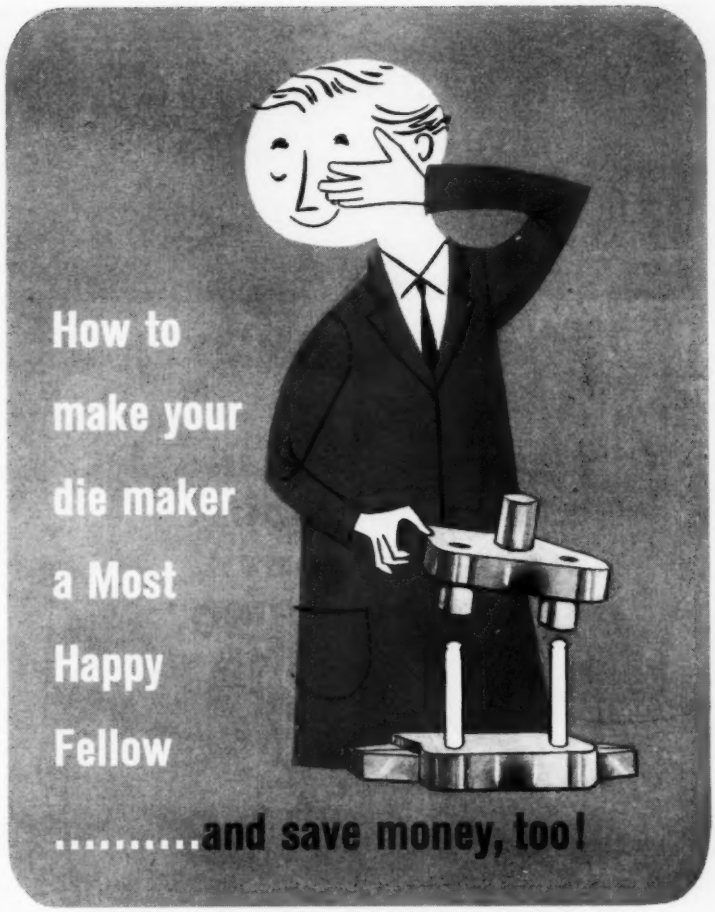
8. Select shank diameter for the press on which die will be run.

9. Choose grade of precision required—Master or Commercial—based on tolerances and number of pieces to be produced.

10. Order die set which meets most closely the above requirements, making certain that *all* ordering information is included: Catalog number and quantity; Master (Precision) or Commercial grade; length of guide pin; type of bushing; diameter of shank or "no shank"; how to ship. Keep in mind that special thicknesses of punch holder and die holder can also be ordered if required.

Of course, you may not find it possible to check these points in the exact sequence presented. However, if you will make it a habit to use this check-list for each die set you need, you can avoid making costly errors in ordering.

*"L" dimensions pertaining to pin length as shown in die set catalogs refer to distance from bottom of die holder to top of pins. They do not necessarily apply to actual guide pin lengths.



It's easy. Just be sure to specify Producto die sets with *Qwik-Fit guide pins.*

Then your die maker will always be able to assemble and disassemble his die sets practically blindfolded! No longer will he have to line up pins and bushings cautiously...tediously hammer die sets together...or pry them apart. With Qwik-Fit guide pins, the die set almost *puts itself together.* The spherical-angular radius on these pins prevents jamming or cocking *regardless of how the punch holder is started on.*

Think of the time your die maker will save...and the money *you* will save. Dies are growing more complex daily and that means assembly and disassembly of the die set dozens of times. In plants all over the country, Producto's Qwik-Fit pins are saving up to 75% of the time formerly required for these operations.

To improve morale and increase productivity, join the growing ranks of die manufacturers and users who specify "Producto die sets with Qwik-Fit guide pins." They are available on Master die sets at no extra cost.

HOW TO MAKE ORDERING EASIER:

Get your free copy of Producto's Die Set Catalog No. 11, designed specifically to simplify your selection and ordering job. And ask to receive the idea-filled Die Set Digest, too.

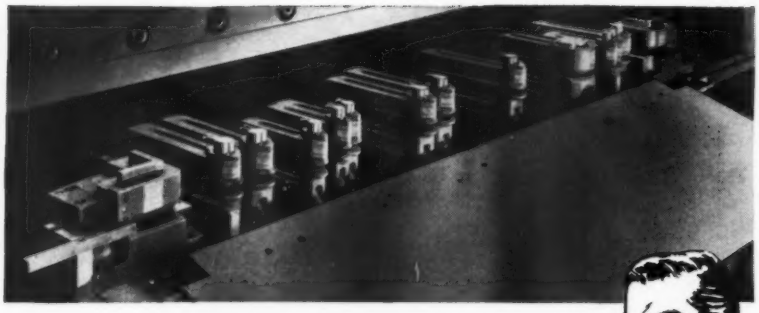
THE PRODUCTO MACHINE COMPANY
970 Housatonic Avenue, Bridgeport 1, Connecticut

Wherever die sets are used

PRODUCTO

PRODUCE MORE WITH PRODUCTO PRECISION DIE SETS

CIRCLE INFORM-A-GRAM KEY NO. 129



"WALES BL TOOLING SAVES US ABOUT HALF THE COST OF HOLE PUNCHING"

"**WALES BL TOOLING** is fast and accurate in our shop. Punches, dies and stripping mechanism are all contained right in the tooling, so our presses have a minimum of down time for change-overs. BL's are just about perfect for punching stock up to ⅛" thick and we get any type of pattern needed with the same units."

Nothing attached to the press ram. Alignment of punch and die is permanent. Notching equipment may be used in same set-up. Inventory is kept down and PRODUCTION UP!

SEND FOR BULLETIN NO. 27H

The complete story of BL tooling is here for the asking. Send for your copy today.

WALES Strippit COMPANY

A UNIT OF HOUDAILLE INDUSTRIES, INC.

AKRON, NEW YORK

WALES-STRIPPIT OF CALIF., SOUTH GATE, CALIF.
WALES-STRIPPIT OF CANADA LTD., HAMILTON, ONT.

"...the Wales-Way is the PLUS-PROFIT way"

CIRCLE INFORM-A-GRAM KEY NO. 130

. . . Spinning Holes from page 128

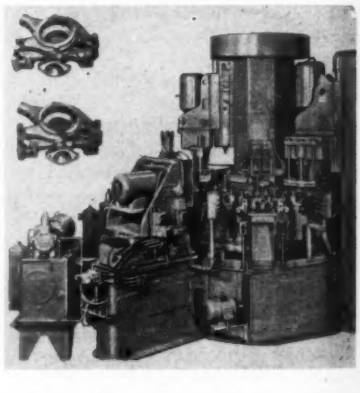
reaches white heat, approximately 2000° F. The metal around the hole is thickened to ¼" as it is pushed inward by the ball end of the rod.

Approximately 3000 holes can be spun before regrinding. This contrasts with about 100 holes/grind for cast alloy steel tools which were tried first. Kentanium rods are reground when a groove about 0.008" deep is produced by first contact with the ¼" dia hole.

SPECIAL MACHINE IS CONVERTIBLE TO OTHER OPERATIONS

A recently delivered machine demonstrates how a special machine may be custom designed and built to obtain maximum production within the customer's appropriation, and also lend itself to conversion for other machining operations.

Two noteworthy features of this Buhr Economatic machine are, first, its ease of conversion to machine other parts and, second, the automatic index unit, to actuate the table, is readily detachable and may be removed without disturbing any other part of the machine.



Processing 102 pcs/hr at 100% efficiency, this machine was specifically built to perform the following 55 operations on an automotive water pump housing, after mounting pads have been previously ground — (1) milling, (18) drilling, (10) reaming, (7) chamfering, (10) tapping, (7) spotfacing, and (2) boring.

Other features include automatic clamping of parts, automatic lubrication of fixtures and all moving parts, steel hardened-and-ground detachable ways, complete interchangeability of standard and special parts, automatic chip removal, and J.I.C. hydraulic and electrical standards.

MOORE SPECIAL TOOL COMPANY

Holes, Contours, Surfaces

Published in the interests of greater accuracy and quality in the tool room and on the production line by the Moore Special Tool Co., Inc., 726 Union Ave., Bridgeport 7, Conn., builders of Jig Borers, Jig Grinders, Panto-Crush Wheel Dressers, Precision Rotary Tables, Motorized Centers and a complete line of Hole Location Accessories.

Why you should use the Jig Borer and Jig Grinder to inspect their own work

In more than 90 per cent of all cases, the Moore Jig Borer and Jig Grinder provide the most accurate and efficient means for inspecting their own work. The advantages include:

1. Considerable saving of time results from checking the piece in the original setup, *while still in the machine.* In addition, should an error be discovered—the work is *in position* for correction.

2. The same directness which reduced sources of locational error in comparison to toolmaker error also reduces the number of steps and sources of error in inspection.

3. The machine's measuring system is fully as accurate as *any* standard that might be used in its stead. The inspection values, determined by means of this system, are likely to be *more* accurate than those attained by any other shop standard because reorientation errors are eliminated.

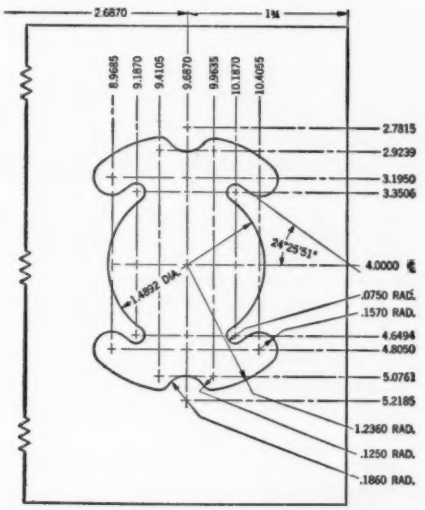
4. The machine spindle provides a rotatable mounting for an indicator. Holes can be picked up directly in this manner, without use of plugs or pins. Out-of-roundness, often mistaken for out-of-location, is easily detected and identified. Full 360° rotation of spindle provides a double indicator reading of any error, thus increasing readability. By vertical movement of the spindle and indicator the shape of the hole can be explored, revealing taper, bellmouth or barrel shape.

5. Contours, one of the most difficult, time-consuming jobs of inspection, can be rapidly and accurately measured and inspected by use of the "indicator measuring" technique. The drawing at the right shows dimensions to be inspected on a complex contour. Of this job it might well be said, "How *else* would you inspect it?"

6. Work jig bored or jig ground to *polar* coordinates on the rotary table can be inspected to *rectangular* coordinates in the same setup. This not only provides a check on possible errors in settings; it eliminates sources of rotary table errors.

7. Paradoxically, the machines will actually inspect somewhat more accurately than they will locate, under most conditions. During inspection, both machine and work are free of vibration, stresses and temperature differentials, so that the accuracy of the measuring system is undiminished.

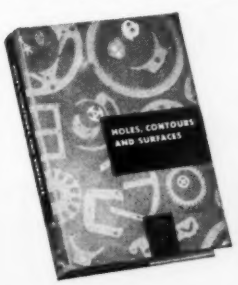
8. A microscope, interchangeable with the indicator in the machine spindle, can pick up surfaces and small holes which cannot be conveniently reached with an indicator point.



Without modern methods, this contour presents a serious problem to inspect as well as to machine.

Get ALL the answers from this new, 424-page book

The information on this page is just a sample of the valuable, on-the-job aid you can get from Moore's *all-new* book, HOLES, CONTOURS AND SURFACES. Tells you how to produce tools, dies and precision parts the *modern way.* 424 pages, 495 illustrations. 184 pages of Woodworth Coordinate Location Tables from 3 to 100 holes. Price only $5 in U.S.A., $6 elsewhere. Send check or money order to Moore Special Tool Co., Inc., 726 Union Ave., Bridgeport 7, Conn.



There IS a Big Difference in Saw Blade

Try DoALL *CLAW-TOOTH* on Your Next Job!

How the CLAW-TOOTH blade reduces contour or cut-off *sawing costs* . . .

CUTS ALL MATERIALS—Steel, titanium, brass, iron, asbestos, plastics, wood, rubber and many other metals and non-metallics.

EXTRA FAST CUTTING—The claw-like, positive rake angle teeth literally "pull themselves" into the work—providing more penetrating power and smoother chip flow.

EXTRA LONG LIFE—Made sharp to *stay* sharp—scientifically designed tooth and gullet shape gives you longer blade life. Teeth are securely anchored to the flexible back to take heavy cutting loads without breakage.

EXTRA EASY CUTTING—Its "bite-in" cutting efficiency requires less feed pressure, resulting in more output with less work per operator.

ACCURACY OF SET ± .002"—Only DoALL *guarantees* this set accuracy. It means you get straight, accurate cutting of virtually any material . . . freedom from binding . . . ability to produce a predetermined kerf size and surface finish.

CLEAN, BURRLESS CUTTING—Means less finishing and grinding costs.

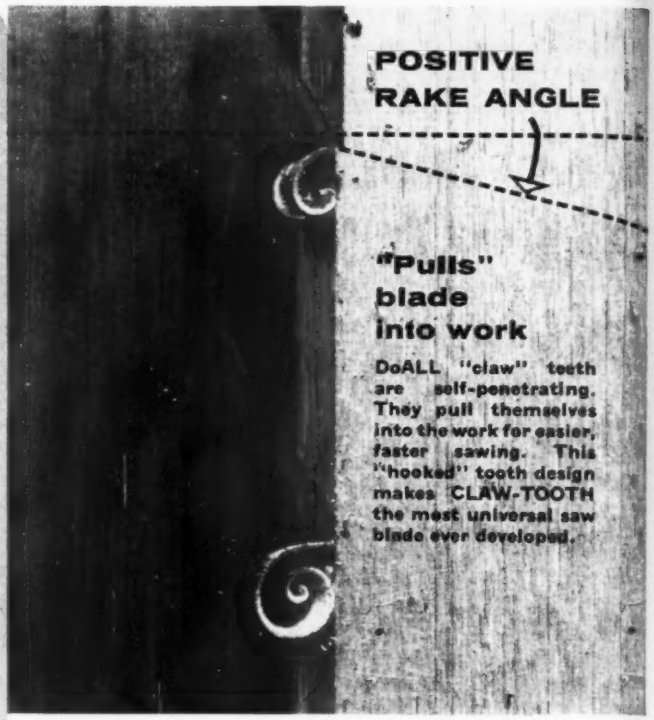
GUARANTEED UNCONDITIONALLY—to be completely free of defects in material, workmanship, heat treating and packaging.

Convenient "strip-out" Containers —

100′ or 500′ coils in exclusive DoALL "strip-out" boxes for convenience, safety and blade protection.

Custom Welded Lengths —

to fit any band sawing machine. Individual packages or cartons of six packaged blades.


POSITIVE RAKE ANGLE
"Pulls" blade into work
DoALL "claw" teeth are self-penetrating. They pull themselves into the work for easier, faster sawing. This "hooked" tooth design makes CLAW-TOOTH the most universal saw blade ever developed.

Available in CARBON or HIGH-SPEED STEEL

They'll saw faster on any machine!

There's a DoALL saw band for every machine and job . . . but the blade that handles *more* jobs *better* is the CLAW-TOOTH! For cut-off jobs or contour sawing, the versatile CLAW-TOOTH blade can reduce both your sawing costs and blade inventory.

Available in ¼" to 1" blade width—2, 3, 4, and 6-pitch. For lowest cost per square inch of cutting, specify DoALL CLAW-TOOTH. Or, if you have a special sawing problem, ask about DoALL's free blade selection service—complete recommendations will be furnished for your job.

Call DoALL locally for details, or send for FREE catalog listing complete line of DoALL band tools.

Find Your DoALL Store In The 'Yellow Pages'

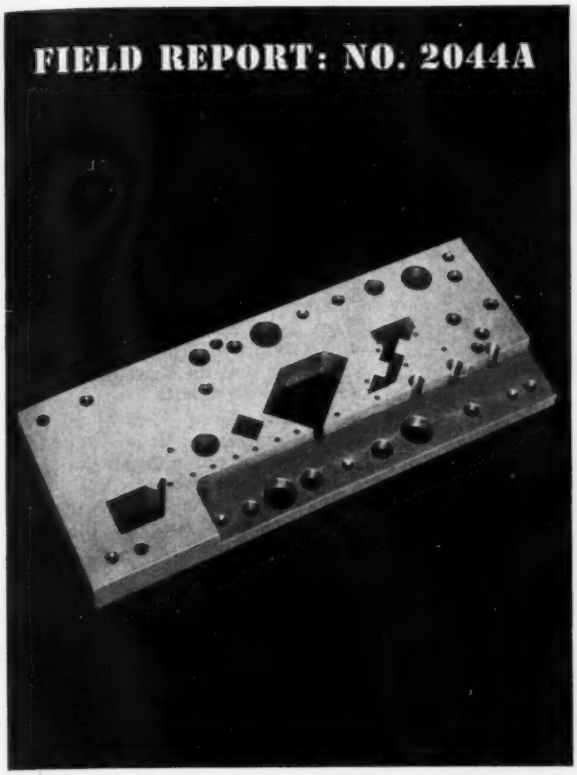
DoALL

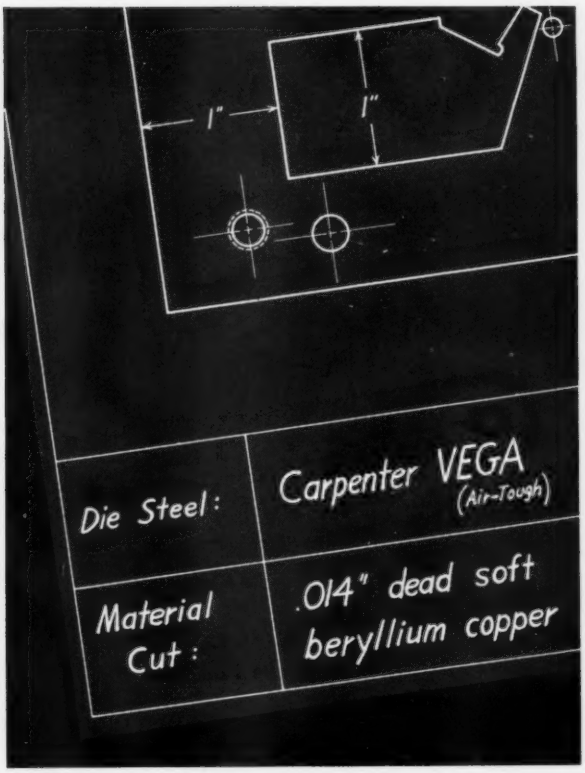
THE DoALL COMPANY, Des Plaines, Illinois

THIS IS A TYPICAL DoALL STORE

Call Your DoALL Service-Store

CIRCLE INFORM-A-GRAM KEY NO. 132





WHICH DIE STEEL WOULD YOU USE

for hardening accuracy, safety in this critical die section?

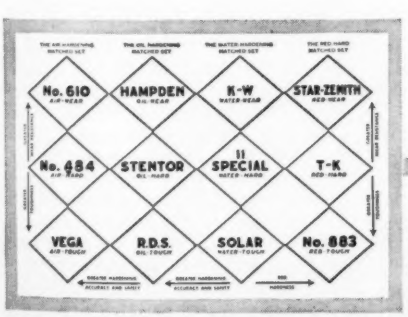
Imagine the problems involved in making and heat treating this critical die section for cutting parts from .014" dead soft beryllium copper.

Numerous cut-outs, sharp corners and thinner sections milled almost through the length of the die present man-size problems in getting the section out of heat treatment safely and accurately.

Which die steel would you be willing to trust on this ticklish job?

Here are the results reported by the diemaker, who chose Carpenter VEGA (Air-Tough) Die Steel for the job: "The section is made from a piece of VEGA 1" x 5" x 12". To hold the stock in line, we had to jig bore and hold a line of ⅛" pilots almost through the entire die length. VEGA permitted us to do this and *saved many hours of work* over a die made from small sections. The first large perforating punch was also made from VEGA. After heat treatment, the punch *entered the die perfectly*. If there was any warpage at all in the punch, we couldn't find it."

This kind of performance is readily available to you by simply calling your nearest Carpenter Mill-Branch Warehouse, Office or Distributor. Large local stocks of Carpenter Matched Tool and Die Steels assure immediate delivery.



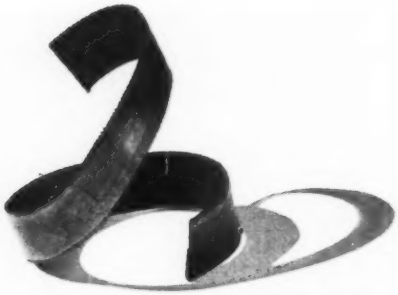
Carpenter STEEL

Matched Tool and Die Steels

The Carpenter Steel Company, 106 W. Bern St., Reading, Pa.

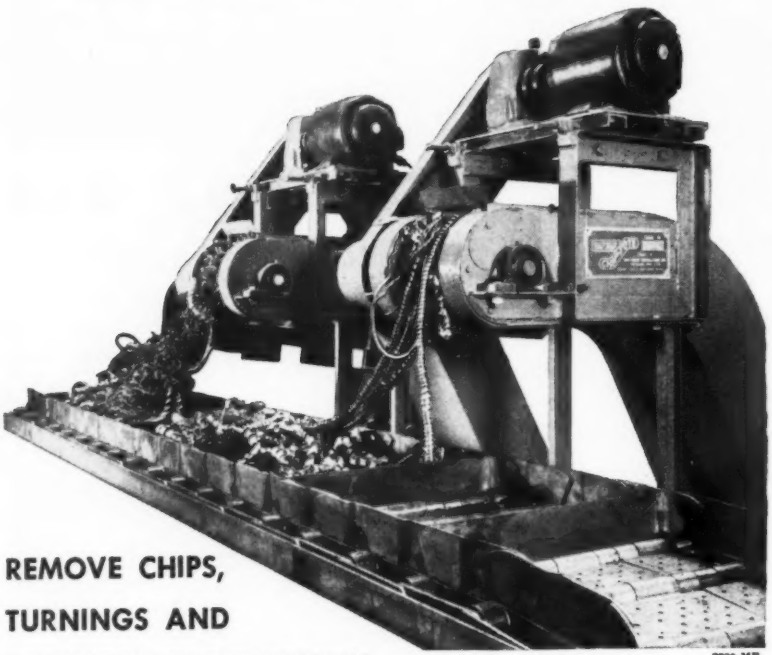
Export Dept.: The Carpenter Steel Co., Port Washington, N. Y.—"CARSTEELCO"

® U. S. Patent Office, The Carpenter Steel Co., Reading, Pa.



LOOK...NO HANDS!

That's right! The May-Fran CHIP-TOTE permits the continuous operation of machine tools by eliminating down-time for scrap removal . . . skilled workers stay on the job . . . production increases by as much as 20%! Versatile CHIP-TOTE conveyors are available in a wide range of sizes to serve practically any type or size of machine tool. Conveyor speed is adjusted to meet the scrap removal needs of the machine.



7720-MF

REMOVE CHIPS, TURNINGS AND BORINGS CONTINUOUSLY AND AUTOMATICALLY WITH A MAY-FRAN CHIP-TOTE

Write today for your copy of Bulletin MF-640

MAY-FRAN ENGINEERING, INC. 1726 Clarkstone Rd., Cleveland 12, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 134

FIRE-SAFE LUBRICANTS FOR AIR COMPRESSORS

The increasing trend towards fire-resistant industrial products, evidenced most notably in recent years in hydraulic fluids and cleaning solutions, has now spread to air compressors.

Some 35 years ago, air compressor lubrication was under discussion. The danger that lurked in the high temperatures generated by air under compression was often discussed those days. Then the oils themselves were improved and flash points raised, so that the scare of explosion seemed more remote.

Actually, large users of air compressor equipment have always been concerned about the possibility of disastrous explosions. Lubrication specialists in the field hear much these days about the need for greater safety in this line, just as the same subject is being considered all over the plant equipment, processing and maintenance field.

Compressor men point out that explosions and fires can occur due to a number of reasons:

Excessive valve deposits
Cooler failure
High ambient temperatures
Continuous heavy duty service
Poor maintenance
Over-lubrication

A word about the last-named cause of trouble. It is recognized that to establish a proper minimum rate of lubrication is often very difficult.

When a machine begins to exhibit ring and cylinder wear or just shows dry spots on the cylinder wall, the natural reaction is to increase the rate of lubrication. If a slight increase in the rate of lubrication does not solve the problem, the next logi cal step is to increase the lubrication rate further or to accept the high wear rate. This results in a dilemma as to whether to accept the high cost of rapid wear or to chance a header fire or explosion.

The use of a fire-resistant fluid for lubrication of air compressors is not new. Synthetic fluids possessing some lubricating ability have been tried, but this was before the development of additives to provide increased lubricity and better protection against rust. Such agents being available today, the Houghto-Safe 1000 series of phosphate ester fluids are suitable for air compressor lubrication where fire safety is a factor.

Hazards are greatest, according to engineers of E. F. Houghton & Co., in reciprocating piston and rotary types of compressors. Houghto-Safe 1000 series, developed as fire-safe hydraulic media where temperatures and pressures run high, are suited to both those types. They should not be used to lubricate the drive en-

. . . *Continued on page 136*

Fellows Leads Again!

Now Fellows introduces the new *"12-350"* Injection Molding Machine! It's the fastest fully-automatic 12-ounce machine on the market... dry cycles at 700 cycles per hour, makes shots up to 20 ounces (with the optional Pre-Pac device)! It's even *faster* in operation than many smaller machines!

Fellows 12-350 handles mold bases up to 20¼" by 33" with 14" draw. Precision controls, grouped for convenience, make set-ups fast and simple for every job, minimize adjustments during the run. Optional kit makes it fully automatic: an operator can run more than one machine.

Ask your Fellows Representative for complete information about the Fellows 12-350 and the other profit-producing Fellows Injection Molding Machines. And ask him about the Fellows Plans for deferred payment, two ways to pay for your machines while they're producing. Just write, wire, or phone any Fellows office.

Fellows

injection molding equipment

THE FELLOWS GEAR SHAPER COMPANY, Plastics Machine Division, Head Office and Export Department: Springfield, Vermont
Branch Offices: 1048 North Woodward Ave., Royal Oak, Mich. • 150 West Pleasant Ave., Maywood, N. J. • 5835 West North Ave., Chicago 39
6214 West Manchester Avenue, Los Angeles 45

CIRCLE INFORM-A-GRAM KEY NO. 135

Pilot Your Way to LOWER COSTS and Higher PRODUCTION!

POWER SCREW DRIVERS
An extensive, versatile line in both bench and pedestal type.

Avoid the Reefs of Production Bottlenecks!

Use **DPS** PARTS FEEDERS and ASSEMBLY MACHINES

- The advantages are too great to overlook: Speed never before equalled . . . Economy . . . Greater Accuracy . . . and Stepped-up Profits. Write for catalog now . . . Tell us your problem . . . Send parts or assembly and our Engineering Department will make recommendations.

BOWL FEEDER
Electrical vibratory type to feed parts that cannot be tumbled.

BARREL FEEDER
with stationary ring cover for heavy-duty production.

DETROIT POWER SCREWDRIVER CO.

2827 W. FORT STREET • DETROIT 26, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 136

. . . Lubricants from page 134

gines. Nor should they ever be applied to oxygen compressors.

In reciprocating piston compressors of the cross head type, the running gear itself does not require a fire resistant lubricant, but Houghto-Safe will do no harm. In this type of equipment, the lubrication system for the running gear is usually completely separated from the lubrication system for the air cylinders so that the customer can continue to use petroleum oil for the running gear while he uses Houghto-Safe for the air cylinders. However, if the equipment is such that a central automatic lubricator distributes the same lubricant to the running gear and the air cylinders, then, of course, Houghto-Safe 1000 series should be used for both.

Full data is now available on that subject, on the use of moisture traps, and on the compatibility of packing materials. Rubber-impregnated leather packings, such as Houghton's No. 1243, have shown up best.

NUMERICAL CONTROL SYSTEM APPLIED TO DRILLING MACHINE

A numerical control system that automatically positions a workpiece to any square on a $\frac{1}{64}$" grid within an area of 8" x 16" has been applied to a drilling machine. The system called "Digital Positioning" is readily adaptable to other machines including automatic welders, punches, and stampers.

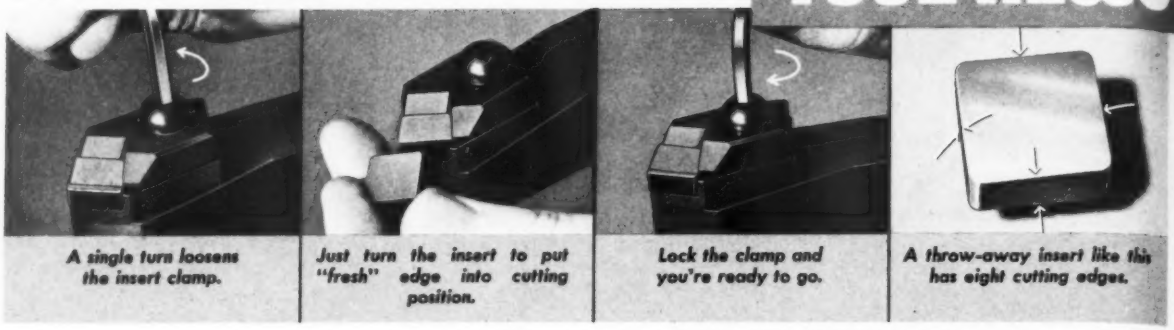
This development of Laboratory for Electronics, Inc. can be modified to a turret drilling head, and the grid system to a decimal value of less than .001".

Accumulated errors are avoided as all dimensions are read from one given reference point, and the lack of balanced precision parts in the electronics sections provides greater accuracy and service economy.

carbide
TOOL NEWS
All you need to sharpen any of these WESSON tools is an Allen wrench . . .
(see page 2)

in just ten seconds . . .

TOOL NEWS carbide



A single turn loosens the insert clamp.

Just turn the insert to put "fresh" edge into cutting position.

Lock the clamp and you're ready to go.

A throw-away insert like this has eight cutting edges.

How to Sharpen Tools with an Allen Wrench!

All of the **WESSON** tools shown on the preceding page are based on the use of indexable "throw-away" tips. When a cutting edge becomes dull, you simply index the tip to a sharp new edge. After all edges (up to eight) are dulled, the tip is simply discarded.

Lathe Tools

Experience shows that **WESSON** throw-away tooling is economically suited to at least half of all single point tool operations. There is no tool grinding. Once set up on the machine there is no further setup time. Downtime for tool changes is reduced to the minimum. Ask for Bulletin #5510-M.

Milling Cutters

Since it takes more time and costs more to sharpen or set up milling cutters than single point tools, the economic advantages of throw-away tooling in milling cutters are multiplied over single point tools. Moreover, the new **WESSON** milling cutter body, developed and designed specifically for throw-aways, gives ample support even for those heavy roughing cuts. Each blade is indexed just as in a single point tool and requires no adjusting.

Boring Tools

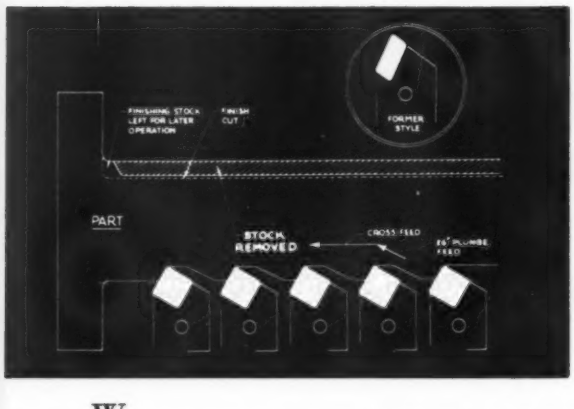
WESSON micro-adjustable boring tools with throw-away tips are sweeping the field. Setup is simplicity itself, an Allen-type screw head being provided with a dial graduated to 0.001 inch (each turn is 0.025 in.). Once adjusted the tools stay put. Round, triangular or square inserts can be used with only minor parts changes. Ask for Bulletin #MB-157.

Flash!
Big Carbide Study Now Being Completed

A national survey of practices in industry in specifying, purchasing, and applying carbide tools is now being completed by **WESSON** Company. Methods of reducing costs are included. If you want an advance copy of the findings, reserve your copy today. Write MARKET RESEARCH DEPT., **WESSON** COMPANY, 1220 Woodward Heights Boulevard, Ferndale 20, Michigan.

tools Wesson carbide Wessonmetal

WESSON COMPANY DEPT. AC
1220 Woodward Heights Blvd., Detroit 20, Mich.
IN CANADA:
WESSON CUTTING TOOLS, LTD.
93 JUDGE ROAD, TORONTO 16, ONTARIO



Working with Wesson Saves $7200 On 1 Job

When you want to cut tool costs it often pays to break the cost down first. You can often cut it several ways. A **WESSON** service engineer helped prove this on machining OD's of tractor axle shafts.

Tool cost with brazed carbides on a 75 hp lathe was over $2 per shaft.

A study showed that even though a good steel-cutting carbide was used, there was quite a lot of tool breakage. Frequent tool changes made grinding costs high. A lot of time was lost in setups. Pieces per grind also looked low.

The job was tackled progressively like this:

1 The carbide was changed to *Wessonmetal* #26—a more versatile wide-range general purpose steel-cutting grade.

Its toughness cut the tool breakage way down and boosted pieces per tool change.

2 The tool type was switched to standard easy-to-grind-and-index ¾" square "on end" inserts in **WESSON** SDR-86B holders.

This doubled the cutting edges per grind, cut tool costs still more, and practically eliminated all setup time after grinding.

In addition to having cut tool cost from $2.09 to under 7 cents . . .

3 Production per hour was practically doubled—without changing feeds, speeds or depth of cut.

Annual savings on this one job: $7200.00!

Here are the figures:

	Before	After
Cutting speed, sfpm	275	275
Feed rate per rev.	.017	.017
Depth of cut, max. in.	⅝	⅝
Machining time, mins.	6½	6½
Tool change time	5	5
Pieces per hour	2½	5
Pieces per tool change	15	40
Pieces per grind (all edges)	30	320
Pieces per tool/insert	120	2560
Grinding cost per tool	$27.00	$12.00
Initial tool cost	$79.77	$55.28
TOTAL TOOL COST PER PIECE	$2.09	$0.066
Annual savings/machine		$7200.00

LITHO IN U.S.A.

FALCON

KWIKLOK

QUICK CHANGE HOLDERS

with T. I. DRIVE

PAT. NO. 2,612,377

Decidedly New!

OUR—ADAPTERS—Will take SHELL END MILLS, BROWN & SHARPE And MORSE TAPERED SHANK STANDARD DRILLS & REAMERS, STRAIGHT SHANK END MILLS, JACOBS CHUCKS, FLYNN OFFSET BORING HEADS, FALCON T.I. DRIVE STANDARD INTERCHAIN GEABLE COUNTERBORES, SOLID BORING BARS, FLOATING TAP HOLDERS & ETC.

you have waited for...

—FALCON—

KWIKLOK-HOLDERS

Are the quickest of the quick.

Made with NATIONAL STANDARD TAPERS, BROWN & SHARPE, MORSE & ETC.

Just what

—YOU—Can have our latest Brochure just for the asking. It will give you all the PERTINENT ENGINEERING DATA You will want.

WRITE FOR YOUR COPY TODAY

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FALCON

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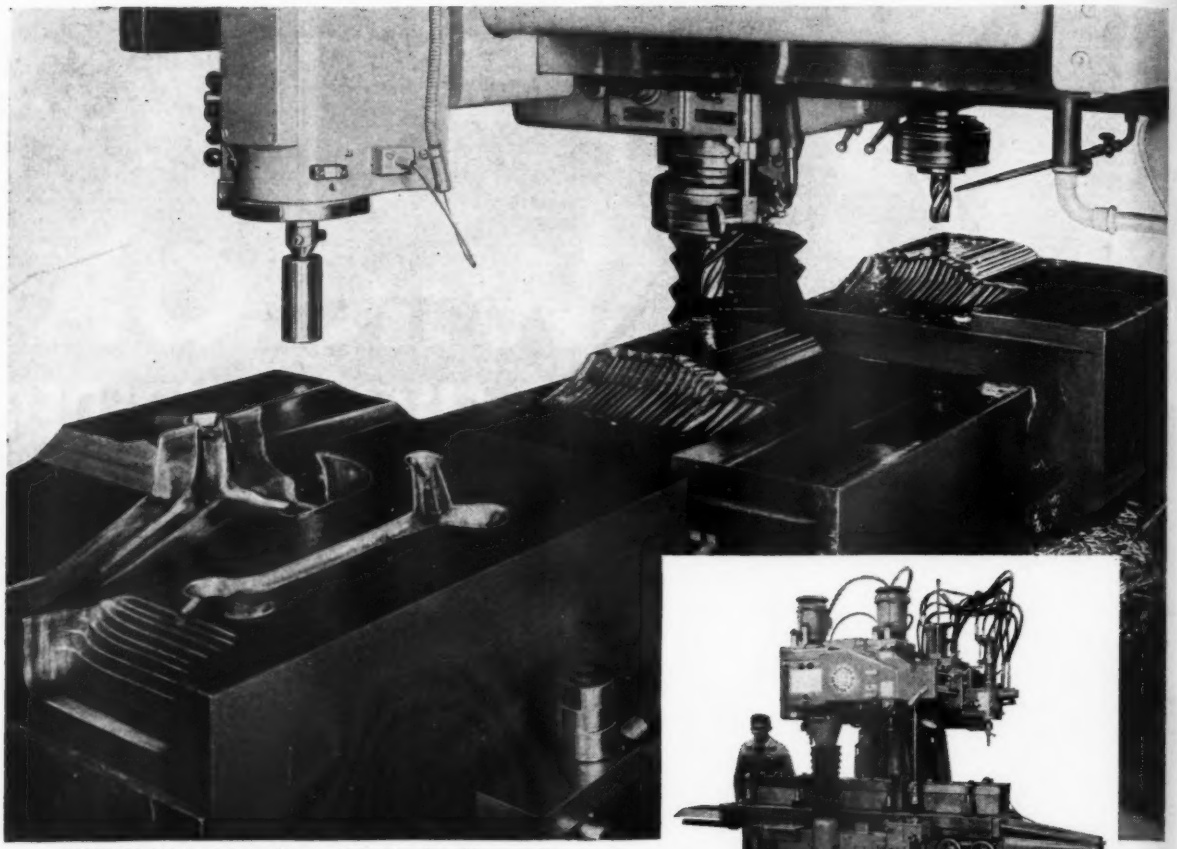
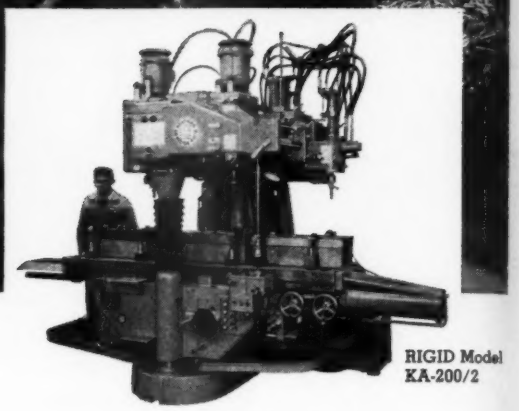
END MILLS • FORM RELIEVED CUTTERS • REAMERS • MILLING CUTTERS SPECIAL TOOLS • MULTIPLE DIAMETER STEPCUTTERS • T. I. DRIVES ON ALL TYPES OF SHANK TOOLS • COUNTERBORES • KWIKLOK QUICK CHANGE TOOL HOLDERS, ADAPTERS AND ETC.



RIGID KA-200/2 rough milling two steering knuckle arm dies



RIGID Model KA-200/2

Rigid ***Provides—***

Fully Automatic Die-Sinking Finer Finish, Less Bench Time

A great improvement in accuracy and surface finish—with no increase in cutting time—is possible with these RIGID Die-Sinking and Hydrocopy Milling machines. Fully automatic machining permits a drastic cut in operator's supervision. Accuracy and high surface finish keep bench time to an absolute minimum—in many cases only polishing is necessary. A completely enclosed frame gives the machine tremendous rigidity to handle extremely heavy cuts. The RIGID is available in three sizes with 1, 2, 4 or 6 spindles. Largest copying area is 23⅝" x 39⅞".

OTHER RIGID FEATURES

- **Normal Working Accuracy of ± .002" or Closer**
- **Completely Vertical Copying, Up or Down**
- **Constant Surface Feed Over Any Contour**
- **Hand Control for Roughing**
- **Reverse Image Attachment**
- **Automatic 360° Profiler With Depth Control (Working Accuracy ± .002")**
- **Change-over from Transverse to Longitudinal Copy-Milling in Seconds**

Write For Additional Information

COSA — *nationwide sales and service of precision machine tools—from bench lathes to boring mills.*

COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.

CIRCLE INFORM-A-GRAM KEY NO. 140

Hydraulic presses are available with a simple hydraulic control or with complete electrical controls as illustrated. T-slotted beds and slides are standard.

All steel welded frames are designed to give easy access for feeding and scrap removal. The mechanical press shown here is equipped with built-in electrical controls.

Give Costs a TRIMMING with NEW CLEARING FLASH TRIMMING PRESSES

Generous bed sizes, ample clearances for feeding and unloading, low initial costs, high speeds—these are the features you'll find in Clearing trimming presses. These presses are available in gap-type mechanical models and in column and gap-type hydraulic models. Capacities range from 30 to 75 tons.

Clearing trimming presses are readily portable by lift truck or crane. When controls are specified, they are built right into the press so that moving the machine from one place to another is greatly simplified. Controls available on these machines may be as simple or as elaborate as you wish. Machines will be furnished without accessories or with deluxe controls which can include "electric eye" safety devices that stop the press if the beam is interfered with.

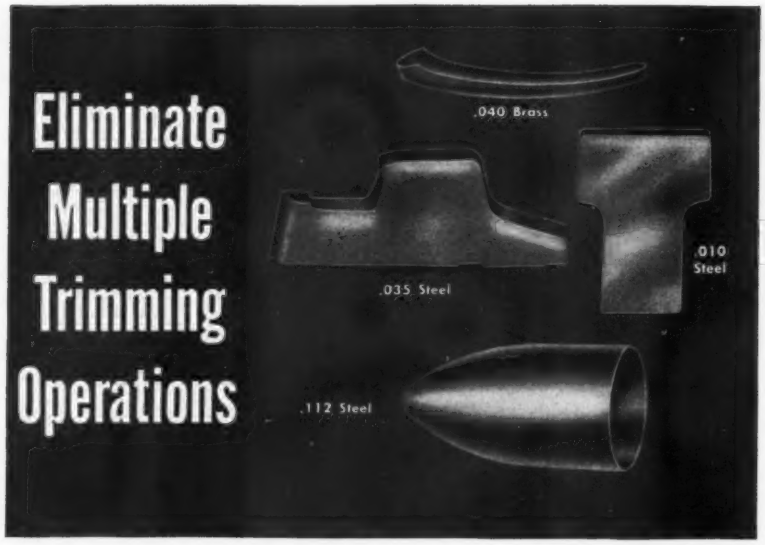
If you have been tying up standard punch presses for trimming work, it will pay you to investigate the advantages of presses which are specifically designed to simplify and speed up your flash trimming operations. Write or call on Clearing for more detailed information.

CLEARING PRESSES THE WAY TO EFFICIENT MASS PRODUCTION

CLEARING MACHINE CORPORATION *division of* ***U. S. INDUSTRIES, INC.***

6499 W. 65th STREET, CHICAGO 38, ILLINOIS • HAMILTON DIVISION, HAMILTON, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 141



Increase output . . . reduce costs!

Costly, time-consuming trimming and notching operations can be done in one operation with a Brehm Trimming Die. Don't worry about stock thickness. Edges will be of full thickness — clean, flat, without burrs or distortion at the trimmed edge.

Other Brehm Die advantages! **Workable Materials** — gold, silver, stainless or mild steel, copper, brass, refrigerator doors, auto bumperbuf zinc, aluminum, fiber, rubber, plastics, **Quantities vary** — Stove or refrigerator doors, auto bumper buffers or typewriter covers, from 264 to 900 per hour. Intermediate parts, where stock and scrap can be blown from the die, about 1200 per hour. **Shapes** — fountain-pen ferrules, artillery cases, watch cases, burial vaults, automotive, kitchen, radio and television accessories and parts. Almost anything you need trimmed.

A Brehm "Shimmy" Trimming Die with angular cams, cuts four ways in one press stroke, handling straight or curved edge contours, with multiple notches and projections. Slow, costly "horn" and "pinch" trimming operations, are eliminated.

Submit part prints for our quotation on shells to be trimmed, or blanked, formed or pierced also.

THE SHIMMY DIE — Brehm® trimming dies

41ST YEAR OF VULCAN SERVICE

ENGINEERING • PROCESSING • BUILDING • TOOLS
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"SHIMMY" AND RELATED DIES • AUTOMATION

VULCAN TOOL CO. (YOUR TOOL ROOM IN DAYTON)
BREHM DIE DIVISION • 741 LORAIN AVENUE • DAYTON 10, OHIO

VULCAN tools

CIRCLE INFORM-A-GRAM KEY NO. 142

"JIGAMAC" QUICKLY LOCATES HOLES FOR JIG DRILLING

The "Jigamac" is a fast, simple, and portable device used where jig drilling and reaming is required for precise location of holes to the accuracy of ±0.0005". It is used in machine shops and toolrooms for heavy maintenance work, and on large flat plates, castings, etc. where size or shape precludes accommodation on jig borers. "Jigamac" is also used for fixed objects after assembly has been completed without necessity of dismantling.

This unit comes in a wooden box containing complete control panel, accessories, and 98 bushes for fractional, number, and letter size drills up to a maximum capacity of ½". The entire unit weighs 43 lbs, and drawings on the cover illustrate the operation.

The "Jigamac" can be employed in any position in any place. Drilling can be carried out on a machine or with a manually-applied portable drill, without affecting the accuracy of the hole. For further details contact Wharton and Wilcocks of America, Inc., 17 Battery Pl., New York 4, or--**Circle Inform-A-Gram No. D1.**

NECROLOGY

Kershaw Harms, 58, vice president of American Smelting and Refining Co., died suddenly July 12.

Walter (Lee) Donnelly, 56, works plant manager of the Tomkins-Johnson Co., Jackson, Mich., died July 7 in Detroit.

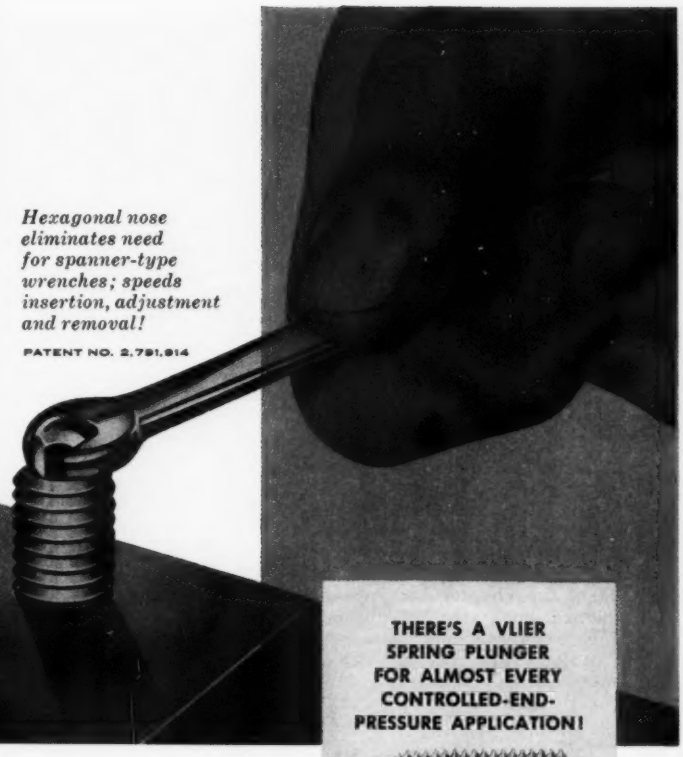
Roger Williams Straus, 65, retired chairman of the board of American Smelting and Refining Company, died suddenly July 28.

F. Ray Peterson, 55, assistant to the president of R. G. LeTourneau, Inc., died July 29 of a heart attack in Longview, Tex.

only Vlier HEXNOSE spring plungers can be installed with an ordinary end wrench!

Hexagonal nose eliminates need for spanner-type wrenches; speeds insertion, adjustment and removal!

PATENT NO. 2,791,914

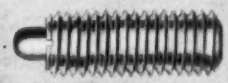


Whatever your spring plunger application—tooling or original equipment—you'll like the ease and speed with which Vlier Hexnose Spring Plungers can be installed.

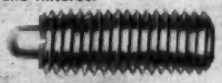
No more hunting for clumsy-to-use spanner-type wrenches or special screw drivers—any ordinary end, socket or crescent-type wrench will do the job quickly and easily.

Since the plunger nose is always easily accessible, the Hexnose really pays off where periodic adjustments must be made. Hardening both body and plunger assures body life. Available in both standard and light end pressure models; 11 sizes.

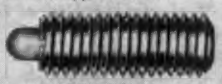
THERE'S A VLIER SPRING PLUNGER FOR ALMOST EVERY CONTROLLED-END-PRESSURE APPLICATION!



Standard
Primarily used in ordinary jigs and fixtures.



Silvernose
Light end pressure for repetitive die applications.



Plastic Nose
For use with aluminum, brass and other soft materials.

Hexnose
For greater ease in installing, adjusting and removing.

Same sturdy construction as other Vlier spring plungers

1. Large bearing surface overcomes binding, assures perfect alignment of the plunger at any extension.
2. Concentricity between plunger axis and body diameter held to .0015" T.I.P.R.
3. Rust-proof finish and National Coarse Class 2A threads prevent freezing in threaded hole.
4. Plunger end telescopes completely within body. Case-hardening assures extreme wear resistance. Ductile core overcomes brittleness and hazards of fracturing under impact, common with hardened, high carbon steels.
5. Spring pressures are accurate, uniform and dependable.
6. Accurately radiused nose speeds loading and unloading of jigs and fixtures.

Send for your 1957 Vlier catalog.

VLIER ENGINEERING INCORPORATED

[illegible] Santa Monica Blvd., Los Angeles 44, California

CIRCLE INFORM-A-GRAM KEY NO. 143

TESTED SCIENTIFIC INVENTORY CONTROL, by W. E. Welch. Published by Management Publishing Corp., 22 W. Putnam Ave., Greenwich, Conn., 1956. 158 pages, $12.50.

This book is aimed at solving two questions: "how much" of an item to make or buy and "when" it is to be made or bought. Helping bridge the gap between the elementary industrial practices and the advanced techniques of operations research and linear programming, the author has tried to use a minimum of high school algebra rather than calculus, in solving the problems.

Some of the chapter headings in this practical book are: distribution-by-value in inventory; working and safety stocks; order quantity formulas, tables, graphs, nomographs, and rules; and making an inventory study.

PROCEEDINGS — NINTH ANNUAL INDUSTRIAL ENGINEERING INSTITUTE, edited by Louis E. Davis. Published by the Institute, University of California, Los Angeles 25, Calif., 1957. 76 pages, $3.50.

Topics covered at the Institute sessions held in both Berkeley and Los Angeles and published in this paper-bound book, include: Planning for Electronic Data Processing; Reducing Costs Through the Use of Capital; Auto-Measurement — Mechanizing Time Study; Physiological Approach to Problems of Work Measurement; Plant-Wide Cost Reduction Programs; Motivating Scientific Personnel; and Human Relations on the Assembly Line. Authors of the papers represent United Air Lines, Standard Pressed Steel Co., du Pont, The Maytag Co., General Motors' Central Foundry Division, Yale University, and other manufacturing firms.

A SHORT DICTIONARY OF MATHEMATICS, by C. H. McDowell. Published by Philosophical Library, Inc., 15 E. 40 St., New York 16, N. Y., 1957. 104 pages.

This highly practical dictionary should be of value to anyone who handles figures and mathematical terms. It explains commonly used arithmetical, algebraic, geometric, and trigonometric terms simply and concisely. The section on trigonometry and geometry is profusely illustrated to help clarify the definitions.

ELECTRONICS IN ACTION: THE CURRENT PRACTICALITY OF ELECTRONIC DATA PROCESSING, Special Report 22. Published by the American Management Association, Inc., 1515 Broadway, New York 36, N. Y., 1957. 176 pages, $3.75 (AMA Members: $2.50).

The value of electronic data processing in terms of improved operations and cost reduction in companies which actually have applied EDP techniques to basic management problems is described in this report.

Representatives of Eastman Kodak, General Electric, and Westinghouse Electric explain how personnel are selected and trained for EDP teams and how EDP systems have been developed and utilized to achieve maximum results. Actual feasibility studies — including one which did not recommend the installation of an EDP system — are included from Tung-Sol Electric, United Merchants and Manufacturers, and Diamond Alkali Co.

One section of the report deals with future applications of EDP to inventory control, expansion planning, and other important areas of management. The report is based on material presented at the Third Annual Electronics Conference sponsored earlier this year by the AMA.

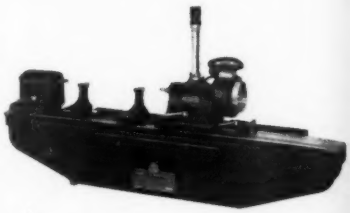
MANUAL OF INSTRUCTION FOR ARC WELDING. Published by The James F. Lincoln Arc Welding Foundation, Cleveland 17, Ohio, 1957. 40 pages, paper-bound, $.50.

The new instruction guide on basic skills of arc welding is written in clear, non-technical language and contains explanatory diagrams, illustrations, and ideas for useful projects. It discusses basic welding techniques and topics such as the effect of heat on metals; common carbon, alloy, and tool steels and their preparation for welding; brazing; cutting; soldering; hardsurfacing; and pipe and sheet metal welding; as well as welding supplies and equipment.

NATIONAL INDUSTRIAL RESEARCH CONFERENCE PROCEEDINGS, "Research for Profit." Published by Armour Research Foundation, 10 W. 35 St., Chicago 16, Ill., 1957. 57 pages, $6.

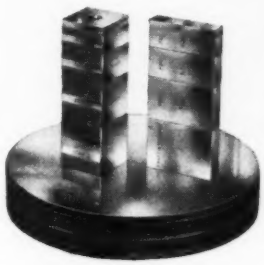
The 12 papers presented on management-level decisions in research and development deal with sales growth through research, more research per dollar, and extra dividends for research. Authors of some of the papers are top executives from Stewart-Warner Corp., Kaiser Aluminum & Chemical Corp., Minneapolis-Honeywell Regulator Co., Johns-Manville Corp., and Borg-Warner Corp.

Basic Equipment for Higher Precision

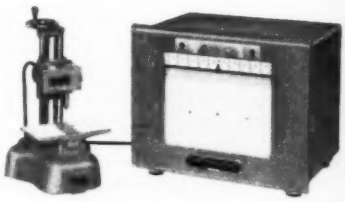


P & W STANDARD MEASURING MACHINE

. . . is used throughout industry to measure gages, tools and finished products for diameter, length, roundness, straightness, parallelism and taper direct to .00001" with controlled measuring pressure.



P & W PRECISION GAGE BLOCKS . . . are the basic standards of precision in thousands of plants. Guaranteed for size, parallelism and flatness within a few millionths of an inch. HOKE Blocks (square type) and USA Blocks (rectangular type) are available in steel or solid carbide.



P & W ELECTROLIMIT MILLIONTH COMPARATOR

. . . was developed by Pratt & Whitney for checking Precision Gage Blocks to a millionth of an inch. An essential item of basic measuring equipment for every plant that must establish and maintain truly high master standards of accuracy.

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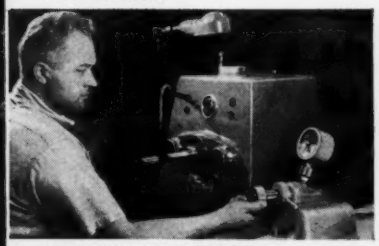
SUPERMICROMETER . . . reads directly to .0001" (.001 mm, if metric). Controlled measuring pressure eliminates operator's errors. Ideal for daily use at machine or on inspection bench.

ELECTROLIMIT COMPARATORS . . . for the ultimate in gaging accuracy. Magnifications up to 110,000 times insure accurate indication of smallest errors.

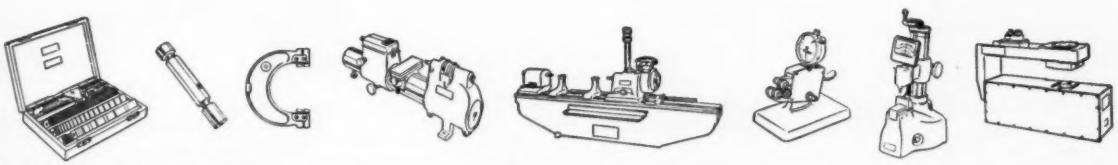


AIR-O-LIMIT COMPARATORS . . . are extremely versatile, check a wide range of products. Readily engineered to your specific requirements.

ELECTROLIMIT SUPERMICROMETER . . . reads direct to .0002". Used as a comparator, it tells operator at a glance exactly how much a part is over or under the required dimension.

Improve Your Quality and Reduce Your Inspection Costs

PRATT & WHITNEY GAGES AND COMPARATORS . . . are available for practically every need and every product. In this complete line, you will find the right gage for use at the machine, on the bench or in the inspection room. You will find that these P&W Gages and Comparators make it possible for you to establish and maintain higher, more dependable standards of product precision and quality and — in addition — will help you reduce your inspection time and costs to a minimum. Write now for complete information, outlining your quality control needs. Pratt & Whitney Company, Incorporated, 15 Charter Oak Boulevard, West Hartford, Conn.



GAGE BLOCKS . . . CONVENTIONAL GAGES . . . SUPERMICROMETERS . . . STANDARD MEASURING MACHINES . . . COMPARATORS . . . AUTOMATION AND CONTINUOUS GAGES

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Coming Events

Sept. 8-11. National Metal Trades Association. Eastern Plant Management Conference. Essex-Sussex Hotel, Spring Lake, New Jersey.

Sept. 8-13. Investment Casting Institute. Second Annual Course on Investment Casting. Massachusetts Institute of Technology, Cambridge, Mass.

Sept. 9-10. 1957 Western Regional Quality Control Conference. Mark Hopkins Hotel, San Francisco, Calif.

Sept. 9-12. Society of Automotive Engineers. Tractor Meeting and Production Forum. Hotel Schroeder, Milwaukee, Wis.

Sept. 9-13. Instrument Society of America. Twelfth Annual Instrument-Automation Conference and Exhibit. Cleveland Auditorium, Cleveland, Ohio.

Sept. 9-13. New York University College of Engineering. Third Annual Titanium Lecture Program. New York University, University Heights, N. Y.

Sept. 15-27. Eighth Annual Statistical Quality Control Institute. University of Connecticut, Storrs, Conn.

Sept. 17-18. ..Radio-Electronics-Television Manufacturers Association Conference on Numerical Control Systems for Machine Tools. Ambassador Hotel, Los Angeles, Cal.

Sept. 17-20. American Die Casting Institute. Annual Meeting. Edgewater Beach Hotel, Chicago.

Sept. 18-20. National Industrial Conference Board. Fifth Marketing Conference. Waldorf-Astoria Hotel, New York.

Sept. 19-20. Marking Device Association. National Meeting. Roosevelt Hotel, New Orleans.

Sept. 23-24. Steel Founders' Society of America. Fall Meeting. The Homestead, Hot Springs, Va.

Sept. 23-25. American Society of Mechanical Engineers. Fall Meeting. Statler Hotel, Hartford, Conn.

Sept. 24-25. Institute of Radio Engineers' Professional Group on Industrial Electronics, American Institute of Electrical Engineers, and Chicago sections of IRE and AIEE. Sixth Annual Industrial Electronics Symposium. Morrison Hotel, Chicago.

Sept. 25-27. American Society of Training Directors. Fifth Annual Conference. Purdue University, Lafayette, Ind.

Sept. 29-Oct. 3. National Screw Machine Products Association. Annual Fall Membership Meeting. Broadmoor Hotel, Colorado Springs.

Oct. 3-4. National Quartermaster Association. 10th Annual Convention. San Francisco, Cal.

Oct. 6-8. Fluid Controls Institute Inc. Fall Meeting, Rye, N. Y.

Oct. 7-9. National Electronics Conference. Hotel Sherman, Chicago, Ill.

Oct. 10-11. National Noise Abatement Symposium. Sherman Hotel, Chicago, Ill.

Oct. 10-11. The Society of the Plastics Industry, Inc. 13th Annual New England Section Conference. Commodore Hotel, New York.

Oct. 14-18. International Industrial Development Conference. Fairmont Hotel, San Francisco, Cal.

Oct. 21-25. National Safety Council. 45th annual Congress and Exposition. Chicago, Ill.

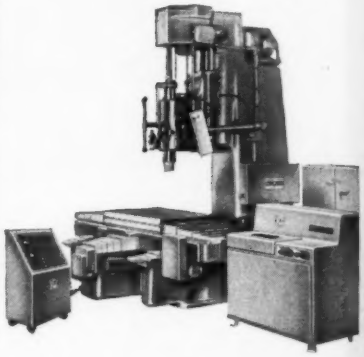
Oct. 24-25. Engineers Joint Council and Engineers' Council for Professional Development. Engineers' General Assembly. Statler Hotel, New York.

Oct. 24-26. National Management Association. 34th National Conference and Annual Meeting. Penn-Sheraton Hotel, Pittsburgh, Pa.

Oct. 28-31. National Industrial Packaging & Handling Exposition. Convention Hall, Atlantic City, N. J.

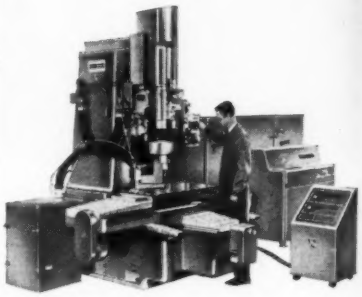
Oct. 30-Nov. 1. Industrial Management Society. 21st Annual National Time and Motion Study and Management Clinic. Sherman Hotel, Chicago, Ill.

PRATT & WHITNEY NUMERICAL CONTROL APPLICATIONS



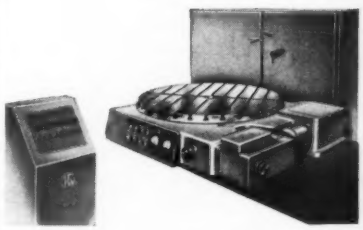
ELECTROLIMIT JIG BORER

Equipped with Numerical Control, the P&W No. 2E Jig Borer is equally suitable for toolroom and precision production applications. Settings accurate to .0001" are made automatically from data supplied by a punched tape or an operator's keyboard.



VERTICAL PRECISION HOLE GRINDER

Table and carriage are similar in design to the No. 2E Jig Borer and the same ultra-precision Electrolimit Measuring System is employed. Column, however, is equipped with interchangeable, turbine-driven grinding heads for spindle speeds to 100,000 rpm.



PRECISION ROTARY TABLES

These Pratt & Whitney Rotary Tables are the ultimate in precision and convenience for circular spacing, graduating and angular positioning. Settings accurate to 5 seconds of arc (2 seconds for repetitive settings) are made automatically from data supplied by punched tape or operator's keyboard.

PRATT & WHITNEY
15 Charter Oak Blvd.

CIRCLE INFORM-A-GRAM KEY NO. 147

TO "TENTHS" IN SECONDS

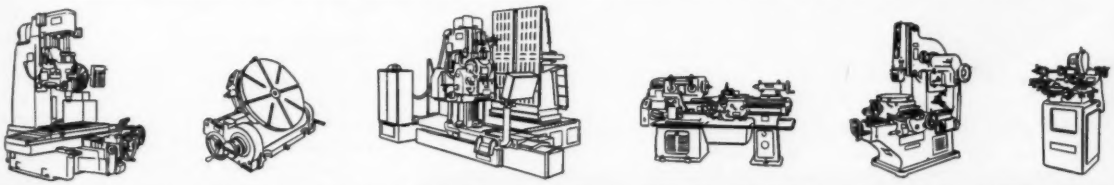
. . . *and no mistakes!*

WITH NEW PRATT & WHITNEY NUMERICAL CONTROL

Operating under Numerical Control, this P&W Precision Hole Grinder is positioned and re-positioned — accurate to .0001" — in an average of only 14 seconds! And since settings are controlled by a punched tape, the chance of work spoilage through operator error in reading blueprint data or setting dials is eliminated. The operator is free to concentrate his attention on work quality.

Applied to Pratt & Whitney Jig Borers, Precision Hole Grinders, Rotary Tables and special machines, Numerical Control not only speeds up toolroom operations, but also makes the high precision of these machines available for efficient short- or long-run production work. In this type work, time savings up to 40% over manual operation are realized. Compare the performance of your present manually-controlled machines with the new standards of speed, accuracy and economy being established by numerically-controlled P&W equipment. If they don't measure up, you are missing important opportunities for improved work quality, larger savings and greater profits.

Write now for complete information.
Pratt & Whitney Company, Incorporated,
15 Charter Oak Boulevard, West Hartford, Conn.



JIG BORERS . . . ROTARY TABLES . . . KELLER MACHINES . . . LATHES . . . VERTICAL SHAPERS . . . CUTTER AND RADIUS GRINDERS

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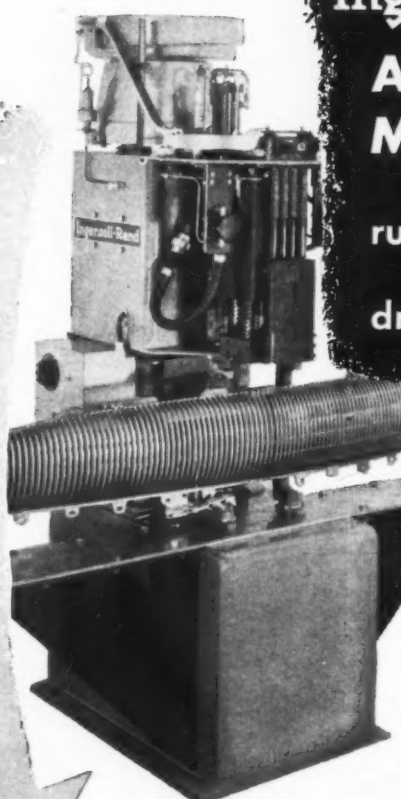
in fastening
... and improve quality, too ...

with
Ingersoll-Rand
ASSEMBLY MACHINES
for
running nuts
and
driving screws!



- first in experience
- first in quality
- first in service

Any bolt size ... any number of spindles ... maintains desired torque manual or completely automatic operation. Write for an Ingersoll-Rand AIRengineer to survey your needs.

Automatic assembly machine feeds and drives four self tapping screws in three seconds.

8-522

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11 Broadway, New York 4, N.Y.

"Commendable Comments"

". . . when a graduated tax is levied on an individual, it is based, at least in theory, upon his ability to pay. But a corporation is not an individual. It is a group of individuals who have pooled their resources and their skills to perform some service desired by their fellow men. And no tax that is levied upon a group of individuals, collectively, bears any relationship whatever to their individual ability to pay."

—Roger M. Blough, chairman of the board, United States Steel Corp.

". . . some corporation executives isolate themselves from their technical researchers. They build a laboratory, equip it with the most modern instruments, then more or less forget about it and expect their research organization to come up now and then, unaided, with some interesting new product. I strongly suspect that these manufacturing executives are the ones most to be blamed if they do not gain effective results from their expenditures for research.

—Robert S. Ingersoll, president, Borg-Warner Corp., at National Industrial Research Conference.

"My own view, is that five additional years of research will be required to make possible a realistic appraisal of the fusion process; in ten years we may be at the point of technical feasibility; pilot-plant production of fusion power will not begin for twenty years; and competitive power production lies beyond that."

—Dr. Guy Suits, vice president and director of research, General Electric Co.

"At least two major problems have 'handicapped a full realization of the potentialities of automation . . .' The first is that 'the businessman concentrates his attention on the hardware or individual machines of automation rather than the system.' The second is that 'important decisions have often been delegated to technicians rather than dealt with as essentially managerial problems'."

—John Diebold, John Diebold & Associates, in Journal of Machine Accounting, Computers and Automation, and Data Processing Digest.

Presenting . . . Representing . . .

Ampco Metal, Inc. has named E. A. Williams & Son, Carlstadt, N. J., as a distributor of its stock raw materials. Non-Ferrous Castings Co., Inc. of Dayton, Ohio, has taken over as stocking distributor of Ampco standard raw materials. A new distributor of the company's Metal Grade 24 stock dies is Tennessee Die Supply Co., Inc. of Nashville.

•

Ogden R. Adams, Inc., has been named Rochester, N. Y., area sales distributor for presses made by Hamilton Division of Baldwin-Lima-Hamilton Corp.

•

The Motch & Merryweather Machinery Co. announces the appointment of Tornquist Machinery Co. of Los Angeles as their representatives in the southern California area. Tornquist will also represent Avery Division of Motch & Merryweather.

•

Hondo Specialty Products of Bell Gardens, Calif., are now stocking distributors of Los Angeles for Porter Precision Products and Durable Punch and Die Co.

•

New representatives for the Colonial-Romulus Division of Colonial Broach and Machine Co. of Detroit are Allied Northwest Machine Tool Corp. of Portland, Ore.; Anderson Machine Tool Co. of St. Paul, Minn.; and R. H. Britton Machinery Sales of E. Syracuse, N. Y.

•

Ember Products, Inc. of Leonia, N. J. have been appointed the representatives of the Alpha Systems Division of the Alpha Tank Co., Inc. Ember will cover northern New Jersey, metropolitan New York, and Connecticut.

•

Yale Materials Handling Division, The Yale & Towne Mfg. Co. has established a sales and service subbranch in Grand Rapids, Mich., to serve the western part of the state. The area will be under the direction of Detroit Sales and Service Branch.

•

Bartley-Priest Co. of Newark, N. J. is a distributor for Sandex Automation equipment and the J.K.A. Dial Comparator and other items made for quality control and semi-automatic production processes. They will serve New Jersey, Pennsylvania, Delaware, and Maryland.

I-R TORSION BAR TORQUE CONTROL

TORQUE CONTROL IMPACTOOLS
consistently run nuts to prescribed torques

I-R Torsion-Bar Impactools now assure top quality control on these 3 operations:

1. *Assembling differential main bearing caps at 450 ft. lbs.* both before and after machining as shown above.
2. *Preloading differential drive pinion bearing* with Impactools set at 375 ft. lbs.
3. *Assembling wheels to wheel hubs at* 425 ft. lbs.

Quality control has risen to a new high for this large manufacturer of farm equipment since I-R Torsion-Bar Torque Control Impactools were installed.

These Impactools are the *only* power wrenches that deliver full power and speed until the preset torque is reached, and then instantly and automatically shut off.

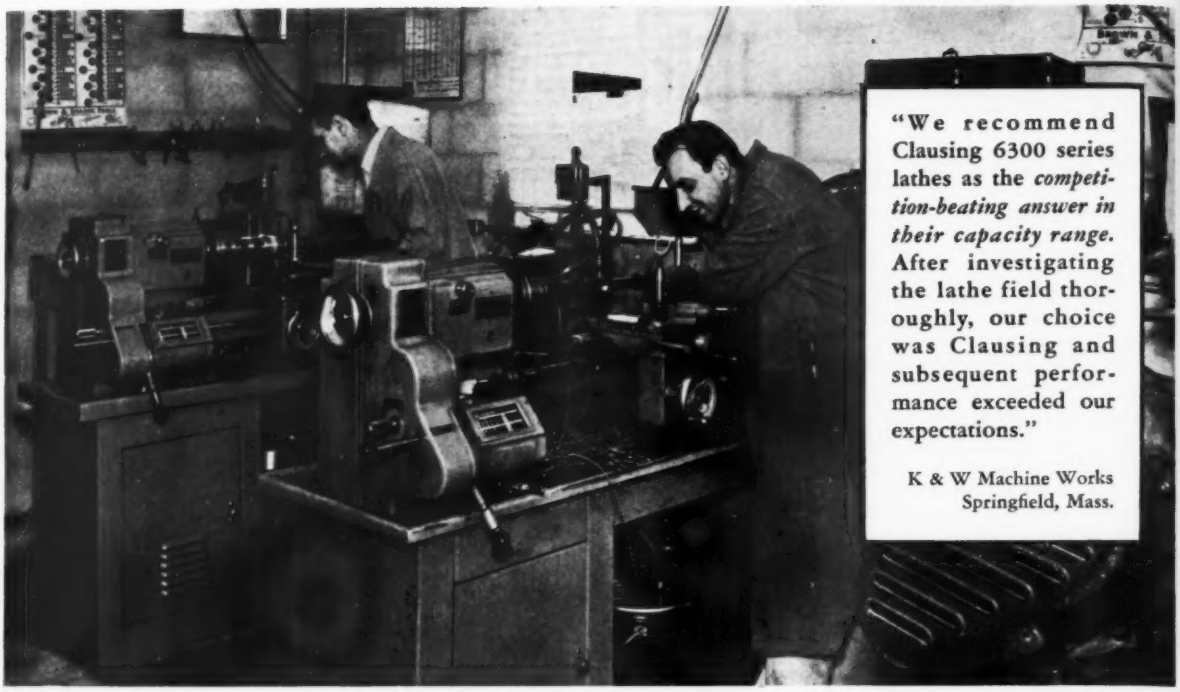
Now, with Torque Control Impactools, the company consistently runs nuts to prescribed torques, saves time, improves quality and eliminates hand torque checking operations.

Write for Bulletin 5170 for proof of how these amazing Impactools can improve quality and cut costs on your own applications.

Ingersoll-Rand
11 Broadway, New York 4, N.Y.

8-524

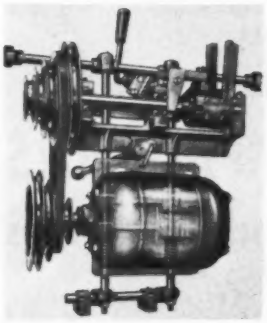
CIRCLE INFORM-A-GRAM KEY NO. 149



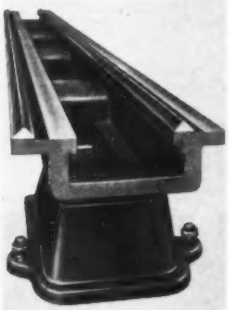
"We recommend Clausing 6300 series lathes as the *competition-beating answer in their capacity range.* After investigating the lathe field thoroughly, our choice was Clausing and subsequent performance exceeded our expectations."

K & W Machine Works
Springfield, Mass.

Production shops report CLAUSING 12¾" lathes best in their capacity and price range



Note the heavy-duty construction of the 10-speed countershaft — the six ball bearings for smoothness and long service. Also available with variable speed or 10-speed countershaft.



Flame hardened bed ways are standard equipment at no extra cost.

CONDENSED SPECIFICATIONS

Swing over bed	12¾"
Between centers	21½", 33½", 47"
Collet capacity, lever type	1 1/16"
Hole thru spindle	1⅜"
Thread range	54 selections, 4 to 224 Standard right or left
Tailstock center	No. 3MT
Motor recommended	1 or 1½ HP, 1 or 2 speed

Within its price range and capacity the CLAUSING 6300 series lathe sets the standards for Precision, Performance and Economy. Its exceptional performance on production, tool room, maintenance and laboratory work is the direct result of its many advanced and exclusive features of design and construction.

For example, the 6300 lathe headstock is fully enclosed and all moving parts run in a *pumped bath of oil.* Spindle is forged, precision-ground steel with 1⅜" bore . . . turns on *"Zero-Precision" Timken tapered roller bearings.* Hardened and ground spindle nose is L-00 tapered key-locked type. Bed ways are *flame hardened.* Quick-change mechanism provides instant selection of 54 threads, feeds. Both quick-change mechanism and double-walled apron are enclosed and *gears and shafts run in bath of oil.* The heavy-duty countershaft has clutch and brake that permits instant starts and stops of spindle without stopping motor. What's more, accuracy is assured! Before it leaves the factory, each CLAUSING Lathe must pass rigid tolerance tests such as:

1. Spindle Nose Runout, total indicator reading....0 to .0003"
2. Spindle Taper Runout, at end of 12" test bar....0 to .0006"
3. Headstock Alignment (horizontal) at end of 12" test bar....0 to ±.0003"
4. Tailstock Spindle Alignment (vertical) high at end of spindle when fully extended....0 to .0008"
5. With work mounted in chuck, lathe must turn round within ....0 to .0003"

See the new CLAUSING at your nearest Atlas-CLAUSING dealer's before you decide on *any* lathe. Write for catalog TODAY!

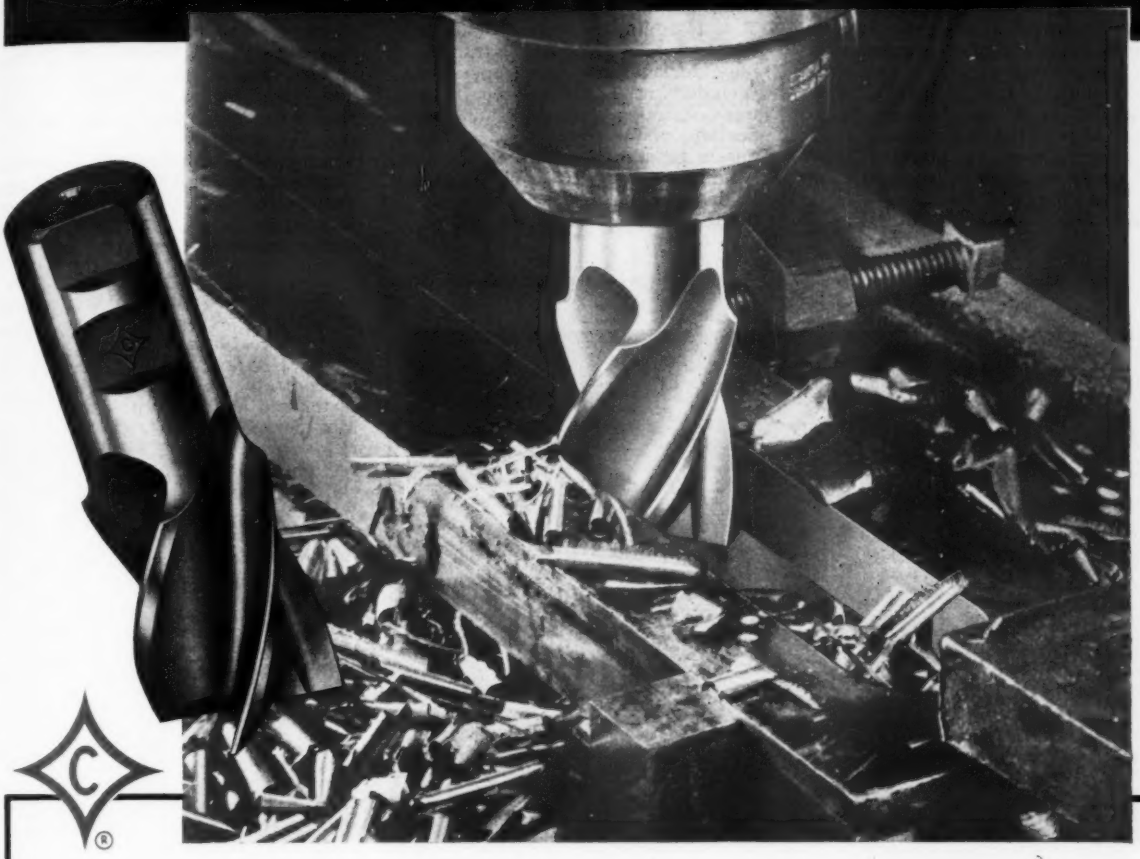
Atlas CLAUSING DIVISION ATLAS PRESS COMPANY PRECISION MACHINE TOOLS

CLAUSING DIVISION, ATLAS PRESS COMPANY

9-115 N. PITCHER ST. • KALAMAZOO, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 150

86% More Slots per Grind



CLEVELAND 500 Series 4-Flute End Mills give Better Performance

On the job illustrated above, conventional 3-flute end mills were averaging 50 slots per grind in SAE 1020 steel. On the same set-up CLEVELAND 500 Series 4-Flute End Mills, with less cutting edge wear and longer size life, increased production to *93 slots per grind.* Yet this is only part of the story. The customer reported that these new CLEVELAND End Mills also gave a smoother finish, greater accuracy and better chip removal *without sacrificing speed or feed.* When you use CLEVELAND 500 Series End Mills you get *all* the advantages of 4-flute mills—and plunge cutting, too! Contact your nearest Stockroom, or . . .

TELEPHONE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR

Request your copy of this helpful, informative book that shows the complete line of CLEVELAND End Mills

THE CLEVELAND TWIST DRILL CO.

1242 East 49th Street • Cleveland 14, Ohio

Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 2 • San Francisco 5 • Los Angeles 58 • E. P. Barrus, Ltd., London W. 3, England

CIRCLE INFORM-A-GRAM KEY NO. 151

Keep Informed • CATALOGS BULLETINS • SPECIFICATIONS

PUBLICATION

For Ease and Convenience Use TOOLING and PRODUCTION Inform-A-Gram Cards

New Aerovent Portable Utility Fans and Mancoolers are described and illustrated in a 4-page bulletin. These heavy-duty all-purpose units for spot cooling, drying, or processing come with 2, 4, or 6 blades. Sizes from 16" to 48" can be used for all types of portable or stationary applications. Copies of Bulletin 250-A are being supplied by Aerovent Fan Co., Inc., Piqua 73, Ohio, or —
Circle Inform-A-Gram No. B1.

Featured in A Comprehensive Brochure are the applications of the 921-T cast aluminum tooling plate, and the cast and machined Kirksite A plate for manufacturing operations. Included in the brochure are illustrations, manufacturing data, and specifications of the products. Direct requests for the brochure to Pioneer Aluminum Inc., 5251 W. Imperial Highway, Los Angeles 45, or —
Circle Inform-A-Gram No. B2.

A 22-Page Catalog, "Superpower Magnetic Chucks and Accessories," illustrates and describes rectangular magnetic chucks, rotary magnetic chucks, sine angle magnetic chucks, and magnetic work drivers. Included under accessories are control switch equipment, demagnetizers, and magnetic parallels and V-blocks. Copies of Catalog 412 are supplied by Taft-Peirce Mfg. Co., Woonsocket, R. I., or —
Circle Inform-A-Gram No. B3.

12" Swing No. 2525-V
Logan Screw Cutting Lathe

Brief Logan Lathe Specifications
SWING, 14½" down to 9" . . . CENTERS, 40" to 17" . . . COLLETS, 1" to ½" . . . SPINDLE BORE, 1⅝" to 25/32"

Advanced Design Features
Ball Bearing Headstock . . . Variable Speed Drive on larger models . . . Double V-Belt Drive on smaller models . . . Automatic Safety Gear . . . Precision Carriage . . . 2-V-way, 2-flat-way precision ground bed, furnished flame hardened at small additional cost.

■The Automatic Safety Gear neutralizes sudden overload shocks, automatically disengaging if the carriage or tool jams up, and thereby reduces breakage to all gears from the spindle through the quick change gear box and into the carriage. It is furnished as standard equipment with all Logan 12" and 14" lathes and may be ordered installed on new Logan 9", 10", and 11" lathes. The Automatic Safety Gear can be furnished for any quick change gear Logan Lathe already in your shop at a price of $10.00 for 9", 10", or 11" lathes and $15.00 for 12" or 14" lathes.

The safety gear typifies Logan advanced design and thorough construction. The Logan ball bearing spindle, variable speed drive, precision carriage and rugged, accurate bed are further reasons why you can depend on a Logan Lathe for exacting high speed production and second operations. Ask your Logan dealer for details, or write for the Logan catalog.

LOGAN ENGINEERING CO.
4901 WEST LAWRENCE AVENUE, CHICAGO 30, ILLINOIS
CIRCLE INFORM-A-GRAM KEY NO. 152

Grinding Concentrate 1500 for wet grinding of ferrous metals and titanium is featured in a leaflet. This chemical-type, water-soluble coolant concentrate mixes instantly with water and maintains its clarity over long periods of time. Other advantages, specifications, and mixing directions for different types of materials are also outlined. Write to the White & Bagley Co., 100 Foster St., Worcester, Mass. for your Catalog A-3 and Manual Sheet 3, Section D, or—**Circle Inform-A-Gram No. B4.**

Solve Fastening Problems Involving Adjustment, liquid sealing, and vibration without extra locking devices or wiring, using Republic Nyloc self-locking bolts. These bolts are highlighted in a 4-page folder which outlines the characteristics and offers suggestions for its uses and applications. These bolts are made to customer requirements and are not a stock item. Request copies of the folder from Republic Steel Corp., 3100 E. 45th St., Cleveland 27, or —
Circle Inform-A-Gram No. B5.

200 Clamping Items are presented in a catalog from Northwestern Tool & Engineering Co., 16 Hollier Ave., Dayton 3, Ohio. Also included are new sizes of step blocks and step clamps. Pictures and tables accompany each section of products. Copies of Catalog 25-A are supplied by the company, or —
Circle Inform-A-Gram No. B6.

Repair Leaks in Pipe Lines and Mend split crossarms, posts, beams, etc. with Punch-Lok hose clamps. Other uses, applications, and advantages are discussed in Catalog 300. This illustrated catalog also features hose fittings and tools used with these products. Included is a chart of replacement parts for Punch-Lok tools. Request copies from Punch-Lok Co., 321 N. Justine St., Chicago 7, or —
Circle Inform-A-Gram No. B7.

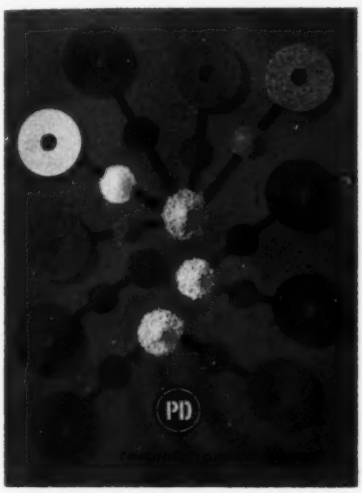
PREVIEWS

Circle postage-free Inform-A-Gram Key Number for your request

TOOLING and PRODUCTION'S Inform-A-Gram Section is a CARDload of Information

Specifications of Over 8,000 Stock Gears, sprockets, worms, splines, and ratchets are featured in an illustrated catalog, with special emphasis on gears and sprockets from ⅛" to 164". Also described are uncoilers, slitters, and automatic feeds and reels for punch presses. Copies of the catalog are supplied by Universal Gear and Machine Co., 1301 E. McNichols, Detroit 3, or —
Circle Inform-A-Gram No. B8.

"Cincinnati Grinding Wheels" describes Cincinnati "PD" Grinding wheels and the positive duplication manufacturing process. In addition, this comprehensive booklet discusses wheel markings and their meanings,



grinding wheel types and uses, characteristics of incorrect wheel gradings, and grinding faults. Direct requests for copies of Bulletin PG-320 to Cincinnati Milling Products Div'n, 4701 Marburg Ave., Cincinnati 9, Ohio, or —
Circle Inform-A-Gram No. B9.

Eliminate the Need for Oil with Oil-Less Air Compressors and Vacuum Pumps. A bulletin explains that graphite piston rings and skirts provide clean oil-free air without requiring expensive oil separators. All models are compact, light in weight and are suitable for portable use or for building into manufactured equipment. These units are available with pressures of 35, 75, and 175 lbs. All applications, illustrations, specifications, and instructions are included in Bulletin GO-1156 issued by Bell & Gossett Co., 8200 N. Austin Ave., Morton Grove, Ill., or —
Circle Inform-A-Gram No. B10.

The No. 2 Unitized Transfer Type Automatic Crankpin Grinding Machine is described in an illustrated catalog. The machine features separate self-contained, easily regulated units. Each unit grinds a single pin on the crankshaft and grinds independently of the other units. Other advantages and specifications are outlined. Catalog 2350-1 is published by Norton Co., Worcester 6, Mass., or—**Circle Inform-A-Gram No. B11.**

Order Reversible Ratchet Gear and Socket Wrenches from the Lowell wrench catalog. Full specifications and details are given for many types of wrenches. It also includes information on special wrenches and a time-saving table for quickly figuring the correct size wrench to fit any bolt or nut diameter. For Catalog 61 write to Lowell Wrench Co., Worcester 8, Mass. for your copy, or —
Circle Inform-A-Gram No. B12.

VARIMATIC®

The SUPER SENSITIVE, SMALL-HOLE, PRECISION DRILLING MACHINE

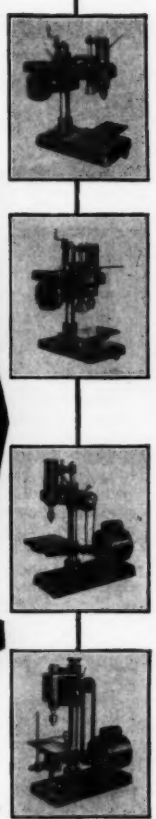
With capacity of .004" to 5/16" in *all* drillable materials, and spindle speeds from 840 to 9300 R.P.M. infinitely variable in two speed ranges . . . *this* is the machine which the precision industries rely upon to handle the "heart-break jobs."

"for the finest work you do"

ALSO . . .
Three companion drills, each built to the same accuracy but differing in drive, speed range, and clearances, to cover the full range of special precision requirements.

AND A TAPPER . . .
with capacity from .034" x 120 to ¼" x 24 . . . and a "reserve of accuracy."

2488



You will want full information about the Hamilton Line of precision drilling and tapping machines. And we will be glad to furnish it.

Ask for our
FREE
BULLETIN NO. 2488

ADDRESS

IT'S A Hamilton Tool
USE IT WITH CONFIDENCE

THE HAMILTON TOOL COMPANY
832 South Ninth Street
HAMILTON, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 153

A JOB THAT ONLY A

Leitz TOOLMAKER'S MICROSCOPE

CAN DO!

- Permits measurements in 2 dimensions plus checking of Radii, Concentric Circles, threads and angles.
- Has exclusive intermediate image system which combines coordinate measuring microscope and optical comparator in one instrument.
- Built-in charts permit use in three magnifications.
- Reads to .0001" or to .00005" from Master glass scales in larger models.
- Available in 1" x 2", 1" x 4", 2.3" x 6", 6" x 6" and 8" x 40" capacity.

FREE BOOKLET— Write for new catalog.

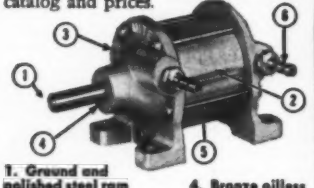
OPTO-METRIC TOOLS, INC.
137 TP VARICK STREET • NEW YORK 13, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 1541

AIR-MITE AIR CYLINDERS

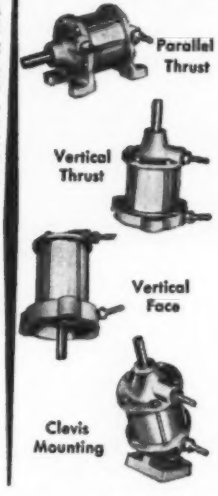
Low Cost . . Compact . . Powerful . . Rugged

AIR-MITE Cylinders—made in single or double acting series—in 4 mounting types, are high quality cylinders at a low price. Simple, rugged design and compact construction give them long life, permit easy mounting on jigs, fixtures, tools, or machines. Used wherever power holding, pushing, pulling or lifting is required, AIR-MITE cylinders will meet your most exacting standards of dependability and long life. Write for complete catalog and prices.



1. Ground and polished steel ram
2. Brass, true-bore cylinders
3. High strength aluminum alloy cylinder heads
4. Bronze oilless ram bushing
5. Five steel tie rods
6. Brass hose stems

4 Mounting Types



AIR-MITE Devices, Inc.
4405A W. KINZIE • CHICAGO, ILLINOIS

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H○LES JIG GROUND with *Vulcanaire*

Provide yourself with this inexpensive* instrument for use on your present equipment and JIG GRIND with a guarantee.

A five station indexing fixture from Vulcan's Contract Tool Room (Your tool room in Dayton).

Using a jig borer index table with the Vulcanaire 5 indexing holes and 35 locating and clamping holes were JIG GROUND in place. Result — eliminated all close locating and dowelling of individual parts and of course hours of time.

*Vulcanaire equipment pays for itself on the first job.

{ Borrow our instructive 11 minute movie on Jig Grinding. }

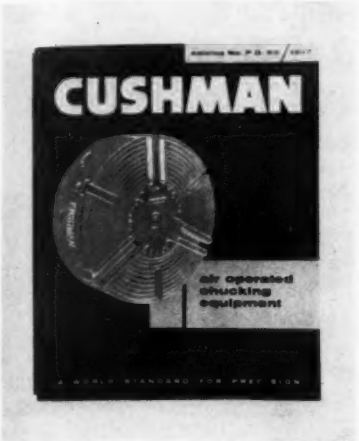
Services of your Tool Room in Dayton
Engineering . . Processing . . Building . . Special Machines . . Vulcanaire Jig Grinders . . Motorized Rotary Tables . . Brehm Shimmy and related dies.
Vulcan's 41st Year

VULCAN TOOL COMPANY
741 Lorain Ave., Dayton 10, Ohio

VULCAN tools

CIRCLE INFORM-A-GRAM KEY NO. 1543

The Line of Air Operated Chucks, cylinders, and accessory equipment is included in a catalog published by The Cushman Chuck Co., Hartford, Conn. The catalog is divided into



seven sections, each of which is step-cut to provide a quick reference to chuck or cylinder descriptions, dimensions, part lists, accessories, and other products. Copies are available from the company, or —
Circle Inform-A-Gram No. B13.

The Airbrasive Cutting Unit is described and illustrated in an 8-page bulletin, "Industrial Airbrasive Unit." It can be used for etching, drilling, light finishing, and similar operations on a wide range of metal, chemical, plastic, and other materials. Factors affecting cutting speed, advantages, and specifications are presented. For copies of Bulletin 5705, write to S. S. White Industrial Div'n, 10 E. 40th St., New York 16, or —
Circle Inform-A-Gram No. B14.

"Precision Tool and Gage Catalog" has been released by Brown & Sharpe Mfg. Co., Providence, R. I. This 96-page, illustrated catalog covers the company's entire line of precision tool and gage equipment. An index in the back of the catalog is helpful in locating specific items. Write to the company for Catalog 36M, or —
Circle Inform-A-Gram No. B15.

A Typical Roll-Over Bucket Application is that of a Louden Selectomatic dispatch system designed to handle the grit and bond used in manufacturing abrasive products. This is only one of the variations and uses of this system. A 20-page catalog discusses the applications and illustrations and diagrams show possible arrangements of the system. This catalog, "Automatic Materials Handling," is prepared by The Louden Machinery Co., 900 Broadway, Fairfield, Iowa, or —
Circle Inform-A-Gram No. B16.

Plate a Wide Variety of Base Metals with common plating materials with the process for metal strip plating described in a bulletin. This process also features high quality and low cost replacement for clad materials traditionally used in the fabrication of various electronic tube parts. Plated strip also permits application of new assembly techniques. Copies of "Plated Metal Strip" are available from Sylvania's Parts Div'n, 12 Second Ave., Warren, Pa., or—**Circle Inform-A-Gram No. B17.**

A Mechanical Cleaner that removes 92% of oil, moisture and dirt from compressed gas and air lines is described in a catalog. Full information is given for all Aridifier models for airlines of ¾" to 10" diameter. In addition it provides informative tables on the use of compressed air, including cfm requirements for various air tools and spraying operations. Obtain your copy of catalog 357 from Aridifier Div'n, Logan Engineering Co., 4901 W. Lawrence Ave., Chicago 30, or — **Circle No. B18.**

5603

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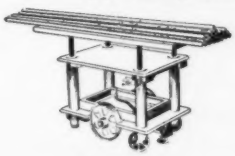
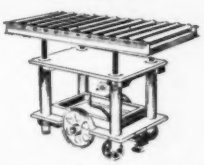
NEW *Convenience*
NEW *Capacities*
NEW *Designs*

PORTELVATOR®

The Handy HAMILTON Portable, Elevating Table





NEW provision for increasing table area!

NEW provision for raising and lowering overhanging loads!

NEW convenience in maneuvering! Six wheel models roll easier . . . turn shorter.

NEW overhanging conveyor tops!

More stamina, more versatile performance than ever before

NEW FREE LITERATURE illustrates and describes all! Write for Bulletin P-5603. Address, The Hamilton Tool Company, 832 South Ninth Street, Hamilton, Ohio.

CIRCLE INFORM-A-GRAM KEY NO. 155

Cut Metalworking Costs with Hamikleer, a liquid that acts as a coolant. Discussed in a booklet, the lubricant and rust preventative eliminates costly disposal problems because it does not contaminate streams, and lasts longer because its water-thin solution holds to a minimum the amount carried away. Hamikleer can be used on cast iron, hard and soft steels, and other ferrous metals. The booklet is available from Harry Miller Corp., 4th & Bristol St., Philadelphia 40, or — **Circle Inform-A-Gram No. B19.**

Save Manpower, Speed Production, and reduce rejects with Assemblimatic special assembly machines illustrated and explained in a brochure. Features of these machines include automatic inspection, selection, orientation, and assembly. Rotary index, in-line transfer, eight station rotary index, and eight station hydraulic rotary are among the special machines which are discussed. Copies of the brochure are supplied by the Omer E. Robbins Co., 24800 Plymouth Rd., Detroit 39, or — **Circle Inform-A-Gram No. B20.**

J&L

REVOLVING TANGENT DIE HEADS

. . . for multi-spindle automatics; drill presses; special machines

- Chasers can be changed in a few seconds without disturbing the die head or *holders*
- Positive, automatic tripping permits threading close-to-shoulder on every piece
- One set of holders handles a full range of coarse, fine and multiple threads

CLASS III THREADS GUARANTEED . . . EVERY TIME

For full information on J&L Thread Tool Products . . .

Automatic Opening Die Heads & Chasers
Automatic Opening Collapsible Taps
Solid Adjustable Taps
Automatic Opening Stud Setters
Modern-Magic Chucks & Collets
A Complete Line of Accessories

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JONES & LAMSON

Class III Guaranteed Not Sometimes, but Everytime!

JONES & LAMSON MACHINE COMPANY, 521 Clinton St., Springfield, Vt., U.S.A. J&L THREAD TOOL DIV.

CIRCLE INFORM-A-GRAM KEY NO. 156

Melting, Temper, Edge, Tolerances, and Capacity Tables are discussed in a 32-page comprehensive catalog, "Cold Rolled Specialty Steels." There is also a detailed description of hardened spring steel. A brief description of many special purpose

items, and data showing hardness conversion numbers, decimal equivalents, and weight-size tables are also included. For your copy of the catalog write to Crucible Steel Company of America, Chamber of Commerce Bldg., P.O. Box 1558, Pittsburgh 30, or—**Circle Inform-A-Gram No. B21.**

A 4-Page Brochure Describes an electric-hydraulic power unit and an air-hydraulic power unit. The publication includes a description of features, photographs, and flow charts for both units. Listings of standard and optional equipment are also included. For more information write to Hi-Shear Rivet Tool Co., 2600 W. 247th St., Torrance, Calif., or — **Circle Inform-A-Gram No. B22.**

Longer Spade Drill Holders for drilling deeper holes are described and illustrated in a catalog issued by Waukesha Cutting Tools, Inc., Waukesha, Wis. This catalog lists specifications of all items carried in stock and also shows special tools designed and manufactured by the company to meet unusual applications. Write to the company for a copy of Waukesha Cutting Tools, or — **Circle Inform-A-Gram No. B23.**

A 91-Page Comprehensive Catalog contains listings of hobs, gear shaper cutters, milling cutters, and other tools. Diagrams and charts illustrate many of the products, and specifications and descriptions are given of many of the tools. Copies of this bulletin are now being distributed by the National Tool Co., 11200 Madison Ave., Cleveland, or — **Circle Inform-A-Gram No. B24.**

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It's the ideal press for that occasional pressing job. These presses operate off ordinary shop air supply. They're fast and safe. Over 30 models to choose from...many for either bench or floor mounting. Capacities from ½ to 18 tons. Daylight to 46 inches...reach to 12 inches. Prompt delivery.

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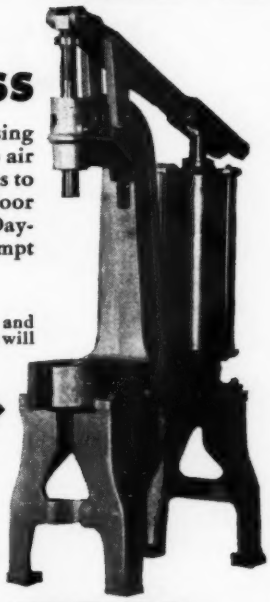
1-ton Hand-D-Press. For small parts manufacturers. Press only, without valves, $230.

Prices F.O.B. our press plant, St. Marys, Ohio, subject to change without notice.



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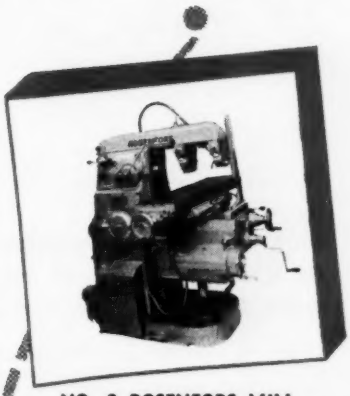

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Dial feed and speed controls. Rapid traverse. Table size 12" x 51". Spindle taper No. 50 National. Spindle speeds 18 or 36. 16 feeds. All gears hardened and ground, all shafts mounted in roller bearings. Weight 4500 lbs.

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Vertical, Horizontal and Angular Combination Mill. Power longitudinal feed, coolant system, 4 H.P. spindle motor, overload protection and push button controls. Spindle is No. 40 N.T. Table size 10" x 40".

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High quality, low cost instrument with range up to 0.100". Reading to 0.001", easy interpolation to 0.0002".

Write for Bulletin 161-54

The Gaertner Scientific Corporation

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CIRCLE INFORM-A-GRAM KEY NO. 1581

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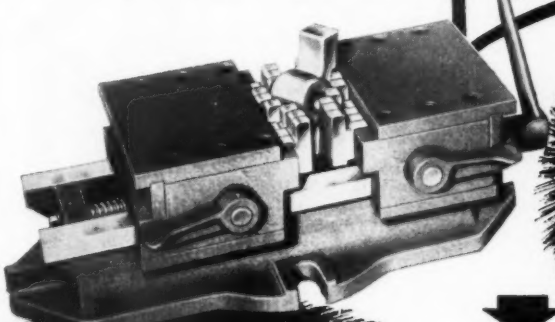
Contour Gripping FIXTURE

SAVES YOU MONEY!



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TAKE BIGGER CUTS

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THOUSANDS OF USES

NO MORE BLOCKING SHIMMING HOLDS ANY SHAPE IN ANY POSITION

This amazing fixture holds any shape in any position . . . for drilling, milling, shaping or grinding. It only has to be set once to take identical pieces for any operation on all types of machine tools.

Investigate its possible application in your business. Write for further details or demonstration.

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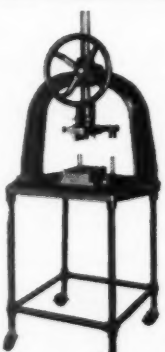
CIRCLE INFORM-A-GRAM KEY NO. 1583



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Here's a truly "one man" press. It operates with one hand. Handy for tool and press rooms, it permits the die-maker to complete a die-set at his bench . . . saves toolroom and handling costs. Ask today for full details.

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CIRCLE INFORM-A-GRAM KEY NO. 1584

Speed, Accuracy, and Economy are several features of Beaver Quick change tools. Other advantages of these tools are presented in a catalog. Adaptors for drill chucks, end mills,

and face mills, and holders for turret milling machines and boring machines are among the tools described. Copies of Catalog 57 are issued by Beaver Tool and Engineering Corp., 500 W. Country Rd., Gaylord, Mich., or—**Circle Inform-A-Gram No. B25.**

Reamers with Interchangeable Heads is the subject of a catalog published by the Tomkins-Johnson Co., Jackson, Mich. The reamers are illustrated and special advantages and features are presented. Also shown are reamer shanks and arbors for reamer heads. Specifications for all products are included. For your copy of Catalog 153-1 write to the company, or —
Circle Inform-A-Gram No. B26.

Reduce the Need for Overproducing and Eliminate the Costs of extra handling and storage with Danly Quick Die Change presses. Features included in the bulletin are: die carriers are individually motor driven; and the presses may be provided with manual, semi-automatic, or fully automatic die clamping. Bulletin P-43.1 are supplied by Danly Machine Specialties, Inc., 2100 S. Laramie Ave., Chicago 50, or —
Circle Inform-A-Gram No. B27.

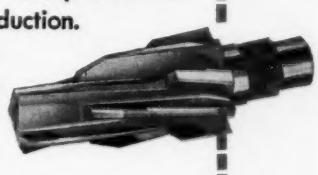
Turn Multiple Diameter Shafts and Contoured Workpieces automatically, accurately, and economically with the tracer lathe presented in a catalog. The 15" and 18" Hydraguide lathes are illustrated, and specifications and advantages are also provided. For more information write for Catalog H-150 issued by Cincinnati Lathe and Tool Co., Cincinnati 9, Ohio, or —
Circle Inform-A-Gram No. B28.

Listings of Many Types and Sizes of grinding wheels are presented in a 10-page catalog. Specifications are also given for the safety surface grinding wheels. Included in the stock are wheels for crush form grinding, surface grinding cylindrical and centerless grinding operations, etc. They can be altered in size and shape to meet special requirements. For copies of the Grinding Wheels catalog contact Simonds Worden White Co., 1108 Negley Pl., Dayton, Ohio, or —
Circle Inform-A-Gram No. B29.

The 36" Tilting Rotary Table is the subject of a leaflet made available by Pratt & Whitney Co., Inc., Charter Oak Blvd., W. Hartford 1, Conn. This table provides through reversible motors power tilting from 0° to 90°, and rapid power rotation through a full 360° of the working surface. Several operations can be performed in a single setup, which eliminates the use of expensive jigs and fixtures. Illustrations and specifications are included in a catalog available from the company, or —
Circle Inform-A-Gram No. B30.

FINE CUTTING TOOLS
by Eclipse

Since 1913 Eclipse has been consistently and conscientiously serving many companies in widely diversified fields of production. Each of these companies has found that "Engineered by Eclipse" is assurance of genuine quality in end cutting tools.



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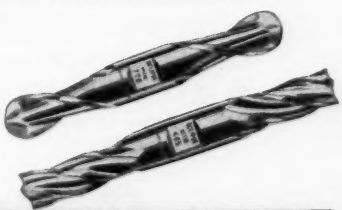
- Core Drills
- Inserted Blade Cutters
- Multi-Diameters
- Back Spotfacers

and remember . . .

Eclipse now has a complete line of Precision End Mills. Ground from the solid, Eclipse End Mills insure longer tool life, finer finishes and lower production costs.

- Write for Counterbore Cat. No. 51
- Write for End Mill Cat. No. 56



ECLIPSE COUNTERBORE COMPANY
DETROIT 20, MICHIGAN
END MILL DIVISION—NORTH BRANCH, N. J. ADDRESS (BOX 97, RARITAN N. J.)

CIRCLE INFORM-A-GRAM KEY NO. 159

Various Applications of Radiant Heating Equipment in metal processing is detailed in a brochure published by Fostoria Pressed Steel Corp., Fostoria, Ohio. Eighteen typical applications are described and data on product heating problems, processing temperatures, time cycles, and oven design are included. Featured are the four sources of infrared energy and where they are best applied to metalworking heating processes. Copies of Bulletin 57-108 may be obtained from the company, or — **Circle Inform-A-Gram No. B31.**

Simplify Heavy-Lift Jobs and Cut Labor Costs with the Weld-Built hydraulic lift tables featured in an illustrated bulletin. This lift table also speeds heavy production operations and has a capacity from one to 15 tons and up. Several models and designs are available for different lifting jobs. Descriptions and specifications are included in the bulletin. Direct requests for copies of Bulletin HT357 to West Bend Equipment Corp., 341 Water St., West Bend, Wis., or — **Circle Inform-A-Gram No. B32.**

57-07

Proof of Precision: This 100,000th Spindle

. . . that's right. Ex-Cell-O has produced more than 100,000 precision grinding and boring spindles. They are in use today throughout the world, on a wide variety of important jobs. No other spindle manufacturer has so solid a record for satisfaction—so sound a reputation for building the best.

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CIRCLE INFORM-A-GRAM KEY NO. 160

A Complete Line of Hinged-Steel Belting is described in a bulletin. Five standard forms of the belting are shown and diagrams together with charted specifications provide all dimensional information. Plain steel, perforated steel, and dimple steel types of belting are available. Recommended applications and simplified assembly instructions on the mass-produced interchangeable components, pre-engineered side chain and drive mechanisms are also included. Bulletin MF-60 is available from May-Fran Engineering, Inc., 1726 Clarkstone Rd., Cleveland 12, or—**Circle Inform-A-Gram No. B33.**

Aisle-Designed Sweepers are Illustrated and Described in a brochure. Model 80 heavy duty power sweeper can clear a 42" path and a powerful suction provides for almost dust-free sweeping. Other advantages and features are outlined in the brochure. For your copy of the brochure write to G. H. Tennant Co., 701 N. Lilac Dr., Minneapolis 22, Minn., or — **Circle Inform-A-Gram No. B34.**

No Bolting or Welding Is Necessary with the Slide-n-Lock adjustable storage rack. A catalog outlines the adaptability of the five basic parts and illustrates the uses of the rack. Dimensions of the various parts are also given. For your copy of this catalog contact American Metal Products Co., Storage Rack Div'n, 5959 Linsdale Ave., Detroit 4, or — **Circle Inform-A-Gram No. B35.**

A 22-Page Catalog Lists the Complete Line of Rivets, burrs, staples, and metal fasteners produced by Cobb & Drew, Inc., Plymouth, Mass. Available fasteners are listed in chart form, and dimensions and specifications are given. Illustrations also accompany the charts. The catalog discusses possible uses of the products and suggests solutions to various riveting problems. **Circle Inform-A-Gram No. B36.**

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A COMPLETE LINE OF END MILLS

Since 1916 Arrow has been a major supplier of End Mills — one of the oldest because Arrow has always been one of the best.

The Arrow line consists of all type of End Mills plus H. S. Steel and Carbide Tipped Specials.

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Significant savings may result if you let our engineering staff assist you. There is no obligation.

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Rousselle Presses are sold exclusively through leading machinery dealers.

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Choice of 25 models in 5 to 40-ton sizes.

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Compression Spring Assortment

Made from music wire. All sizes in diameters 3/32" to 1-1/2". All 10" long. Select the size required and cut to length wanted. Saves time and money.

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FREE 64 Pg. Catalog

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CIRCLE INFORM-A-GRAM KEY NO. 1613

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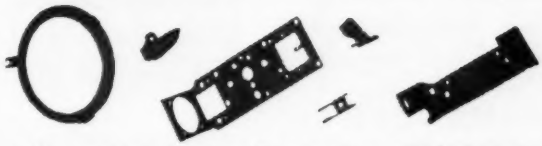

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For This Production Boosting

"TRICO-MIST" COOLANT SYSTEM

For drilling, tapping, milling, sawing, grinding, etc. Removes heat from cutting edges of tools and work. Feeds can be increased considerably, finer finishes and accuracy are obtained. TRICO-MIST absorbs heat, thereby quenching it faster than flood coolants which only transfer it. Chips slide freely up the tool face and are blown away automatically. Simple needle valve controls size and volume of mist spray. Attaches to shop air line. Available with one and five gallon containers — single or multiple outlets — single or dual valve control.

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TRICO FUSE MFG. CO.
MILWAUKEE, WIS. U.S.A.

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.0003 HOLE LOCATION IN 1 MINUTE

EDGE FINDERS

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- THOUSANDS HAVE PROVEN AND ACCEPTED THE DELUXE MODEL FOR YEARS.
- JUMPS SIDEWAYS AS SHOWN WHEN LOCATION IS REACHED.
- NEW .500 DIA. MODEL FOR LARGER WORK ONLY. .200 Dia.

ADJUSTABLE VISE STOP

$2.95

HUNDREDS OF PIECES TO A .0003 TOLERANCE WITH THIS HARDENED VISE STOP THAT IS ADJUSTABLE IN ALL DIRECTIONS. ATTACH TO VISE WITH ONE ¼—20 TAPED HOLE.

Dealer Inquiries Invited

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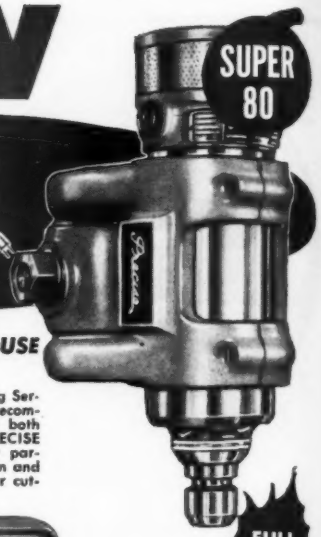

FULL 1½ H.P. AT THE QUILL

HIGH-CYCLE PERFORMANCE WITHOUT USE OF COSTLY HIGH-CYCLE EQUIPMENT

Continuously Variable Speed Range Through Electric Control with Simple Dial Calibration — 7000 to 25,000 RPM.

Largest and Most Powerful Available.

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Unlimited adaptability to single or multiple grinding-milling operations . . . Tolerances of .0001".

Operates from standard 115V power supply.

Our Complete Engineering Service is available for recommendations and advice both on the application of PRECISE POWER QUILLS to your particular production problem and for the use of the proper cutting tool on your job.

PRECISE PRODUCTS CORP.
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KUTMORE ADJUSTABLE HOLLOW MILLS

A MIGHTY MIDGET!

This Midget Floating Holder Hollow Mill, flange type, has micrometric adjustment, and is designed to permit easy compensation for any spindle misalignment. Small, sturdy, extremely accurate!

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It shows complete line of adjustable hollow mills. Our Engineering Dept. is at your disposal for special requirements.

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Monarch Precision SHAPLANE Radius Tools
Illustration shows convex cutter for ¼" to 2½" balls.

FIVE MODELS for LATHES, SHAPERS, PLANERS, BORING MILLS

Range ½" to 3" for concave Radii. Also heavy duty models for radii to 6" on planers, etc.

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Cut Engineering Time, Reduce Component Parts Cost, and insure delivery schedules for mass production operation with Formica laminated plastics. A catalog features the advantages of this product and illustrates its uses and grades. Sheets are available in thickness up to 6" and tubing up to 14" I.D. Direct request to Formica Corp., 4541 Spring Grove Ave., Cincinnati 32, for copies of the technical catalog, or —
Circle Inform-A-Gram No. B37.

The New Operator Engineered Hydrabrasive Precision Surface Grinders are the subject of a new catalog. The features of this machine are shown in illustrations and described in detail. Specifications and standard and extra equipment are presented. Available sizes are 8" x 24", 12" x 18", and 12" x 24". For more information about this Hydrabrasive machine write to Abrasive Machine Tool Co., East Providence, R. I., or —
Circle Inform-A-Gram No. B38.

The Functioning of Chucking Equipment involved in finishing gears by automation is illustrated and described in a folder. Diagrams show the chuck and gear in the open position, loading position, and grinding position. Instructions for each step are presented. For your copy of the folder about automatic bevel gear chucks write to Garrison Machine Works Inc., Dayton 4, Ohio, or —
Circle Inform-A-Gram No. B39.

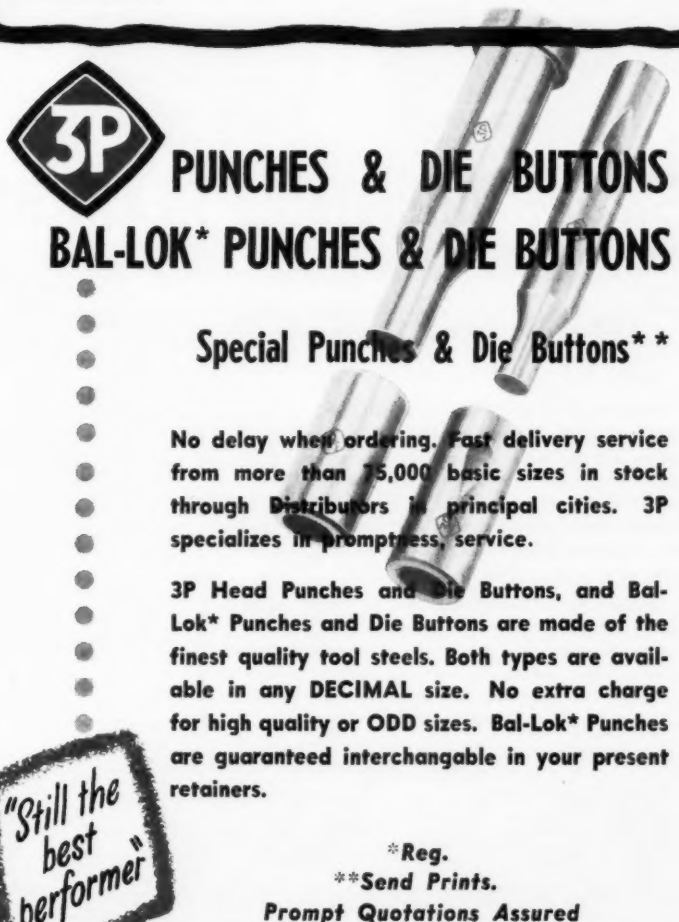
An Illustrated 6-Page Bulletin Describes Product-A-Flow, an expandable bench system, made up of telescoping frame members and exchangeable work panels. The bulletin describes typical bench arrangements, cost-saving applications, and accessories such as modular, bench-top conveyors, work-top storage racks, and posture chairs. Copies of the bulletin are available from Products For Industry, 1530 Summer St., Stanford, Conn., or —
Circle Inform-A-Gram No. B40.

An Illustrated Bulletin Presents the Versa Foot Guard which combines protection against accidental tripping of the actuating valve mechanism and protects against injury for both the operator and actuating device. This guard can be used as a portable supporting base for control valves that cannot be secured to the floor or to equipment. Bulletin 657 is made available by Versa Products Co., Inc., 249 Scholes St., Brooklyn 6, N. Y., or —
Circle Inform-A-Gram No. B41.

Weldirectory of Automatic Electrodes and Fluxes for submerged arc welding and hardsurfacing is now available. This catalog discusses the different types of electrodes and fluxes. A table of typical properties of weld deposits and of flux selection by operating characteristics is given. In addition the automatic welding of alloy steels is also presented. Copies of Catalog SB-1354 are available from the Lincoln Electric Co., Cleveland 17, or —
Circle Inform-A-Gram No. B42.

PIC Counting Instruments are pictured and described in a condensed catalog. Included are small and heavy duty electric stroke and revolution counters, electric counter actuators, coil winding counters, and automatic batch counters. PIC also manufactures special counters adapted or engineered to application requirements. For copies of Form AD 330 write to Production Instruments Div'n, General Controls Co., 714 W. Jackson Blvd., Chicago 6, or—**Circle Inform-A-Gram No. B43.**

FOR THE TOOL ENGINEER WHO NEEDS EVERYTHING *Plus* FAST SERVICE!



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Special Punches & Die Buttons**

No delay when ordering. Fast delivery service from more than 75,000 basic sizes in stock through Distributors in principal cities. 3P specializes in promptness, service.

3P Head Punches and Die Buttons, and Bal-Lok* Punches and Die Buttons are made of the finest quality tool steels. Both types are available in any DECIMAL size. No extra charge for high quality or ODD sizes. Bal-Lok* Punches are guaranteed interchangable in your present retainers.

"Still the best performer"

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**Send Prints.
Prompt Quotations Assured

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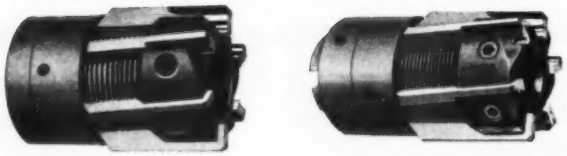
Close Tolerance Work can be continuously maintained on surface grinders with the new Hydra-Cool Hydraulic System described in a folder. The pressure-compensating system with no external relief valves removes hydraulic heat at its source. Other advantages are outlined and comparative tests and a schematic view illustrating the hydraulic circuit are presented. The folder is made available by The Thompson Grinder Co., Springfield, Ohio, or — **Circle Inform-A-Gram No. B44.**

Carbide Tipped Tools are the subject of a 22-page catalog which lists the advantages of these cutters, saws, and drills. Specific material cutting data lists the different types of materials which are cut and suggests possible tools which have been designed for that material. Sizes and dimensions of all these tools are listed in chart form. A copy of the catalog may be obtained from R. Hoe & Co., Inc., P. O. Box 1369, 1809 English St., High Point, N. C., or — **Circle Inform-A-Gram No. B45.**

Get more production—and greater accuracy—at lower cost with

McCROSKY



***Super*® Adjustable REAMERS**

Standard of quality for more than 50 years, McCrosky Super® Adjustable Reamers combine the strength of solid reamers with the longer life, greater accuracy and lower costs of replaceable blade reamers. They cut freely without chatter; avoid any tendency to "dig in", and produce absolutely round, concentric holes with high surface finish. Users report they get more finished pieces—of better quality—in shorter time—at lower cost.

Furnished in machine chucking, shell and hand designs. Carbide tipped, cast alloy or high speed blades. From 13/16" to 6" in diameter. Also "step" reamers; tapered reamers; piloted reamers; and multiple operation combination reaming, facing and counter-boring tools to meet any requirement. Get full details. *Write for Bulletin 19-R—Today!*

Our shop proved screw and pin locking device holds the blades firmly against the bottom and back of the blade slot assuring utmost rigidity. Thrust of the cut increases the locking pressure providing the effect of reaming with a solid tool. Blades can be released easily, and re-ground and re-used over and over again, reducing purchases of new blades to a minimum.

The complete McCrosky line includes:

Jack-Lock® Milling Cutters — *Wizard*® Quick-Change Chucks
Super® Adjustable Reamers — *Block Type* Boring Bars
Turret Tool Posts — *Specially Engineered* Multiple Operation Tools

Fully descriptive catalogs sent promptly on request. Write for yours today!

COST CUTTING TOOLS **McCROSKY TOOL CORPORATION** MEADVILLE, PA.

Engineering and Sales Representatives in the Principal Cities

CIRCLE INFORM-A-GRAM KEY NO. 164

Three Types of Screw Machine Chip Separators are described in a leaflet from the McKenzie Engineering Co. Included is the bench type or the automatic intermediate floor type. The leaflets give full descriptions and instructions of operation. Specifications of the machines are also given. Copies of the leaflets are prepared by The McKenzie Engineering Co., S. Main St., Newtown, Conn., or—**Circle Inform-A-Gram No. B46.**

An Illustrated Bulletin Outlines the Golden Em-re Line of Dial Indicators. This line features extreme accuracy — 1/5 of a graduation over the entire range. Furnished with balanced dials marked in decimal graduation, these indicators permit direct comparison with specification. Also included are lists of the models, ranges, and graduations. Bulletin 557 is released by Petz-Emery Inc., Pleasant Valley, N. Y., or — **Circle Inform-A-Gram No. B47.**

"Enlarge the Usefulness of Any Power Drill with the Pro Versamatic, a reversible speed reducer. It increases its torque and makes it possible to reverse the drill. This product is one of those featured in the revised edition of a catalog. Listings of over forty models of drill chucks, keys, adapters, etc. are given. Copies of Supreme General Catalog 274 are made available by Supreme Products Corp., 2222 S. Calumet Ave., Chicago 16, or — **Circle Inform-A-Gram No. B48.**

Select Eyelets, Ferrules, and Terminals, from a catalog. Included are detailed specifications for the line of copper, brass and steel stampings — flat flange eyelets, regular and special ferrules, and large assortment of terminals. Copies of the catalog are supplied by Waterbury Companies, Inc., Waterbury 20, Conn., or **Circle Inform-A-Gram No. B49.**

Cut a 20" O.D. with a ½" Thick Wall with the Rotator featured in a catalog. The rotary cutting unit has controls that are a combination of hydraulics and electricals. Other features of the machine are described and several detailed pictures are shown. Direct requests for copies to Wallace Supplies Mfg. Co., 1300 Diversey Parkway, Chicago 14, or — **Circle Inform-A-Gram No. B50.**

Adaptable to Either Tangential or Hob Type die heads using tangential or hob type chasers of standard design are the model HA threaders. A leaflet outlines the features, design details, and specifications. Copies of the Model HA threading machine are being distributed by the Hill Acme Machinery Co., Acme Machinery Div'n, 1201 W. 65th St., Cleveland 2, or—**Circle Inform-A-Gram No. B51.**

ABER
Curved Tooth
MULTIPLE CUTTERS

By using the wide range of Standard ABER CUTTERS for gang milling... fast accurate cuts on any number of surfaces simultaneously.

ABER Engineering service will design and make the unit exactly suited to your job . . . send blueprints and specify material to be cut.

ABER Curved Tooth PLUS FEATURES

1. Longer production runs
2. More accurate control of limits and finish
3. Elimination of chatter
4. Faster heat dissipation
5. Shearing action

FREE DATA — 24 page catalog on milling with ABER Cutters.

ABER ENGINEERING WORKS
WATERFORD WISCONSIN

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PRODUCTIVE

PRODUCTO FOOT PRESSES

These sturdily constructed, bench-type presses are ideal for novelty and small stamping or assembly operations. Available in two sizes, both with high output to input ratio. Write for detailed specification sheets.

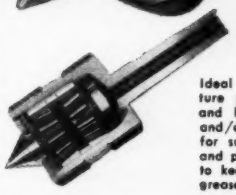
THE PRODUCTO MACHINE CO.
970 Housatonic Ave.
Bridgeport 1, Connecticut

CIRCLE INFORM-A-GRAM KEY NO. 1652

IDEAL GOLD BAND
LIVE CENTERS
GUARANTEED TO MATCH OR EXCEED, "CRITICAL" JOB SPECIFICATIONS

In the GOLD BAND line Ideal has combined the latest production methods with their traditionally fine craftsmanship to bring you an unequalled standard of excellence in live centers. Accurate, (to ± .0001") GOLD BAND Live Centers offer "custom" quality at production prices. Specify GOLD BAND Live Centers and your every need can be accommodated from stock . . . 99 times out of 100. Ideal's GOLD BAND Live Centers offer savings, simplified operations and higher lathe output both in quantity and quality. Contact your distributor today...or

Send for
Complete catalog data and specifications.



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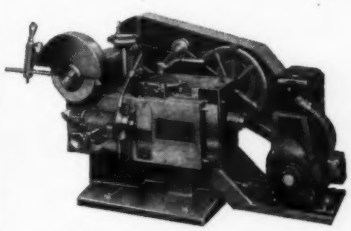
Ideal Live Centers feature precision machined and hardened ball and/or roller bearings for superior accuracy and performance. Sealed to keep dirt out, grease in.

A COMPLETE LINE FOR EVERY NEED...SPECIALS, TOO!

IDEAL INDUSTRIES, Inc.
1334-I Park Ave., Sycamore, Ill.
DISTRIBUTED BY THE NATION'S LEADING INDUSTRIAL DISTRIBUTORS

CIRCLE INFORM-A-GRAM KEY NO. 1653

This Investment PAYS OFF
Automatic Metal Saw Grinder Cuts Cost
. . . Makes Money For You!



Wardwell's "35-T" will sharpen up to 115 saws .015 thick at one time. This includes slitting and screw slotting saws and milling cutters. Takes saws from 2" to 5½" diameter. Completely automatic. No attention is required after machine is started. These ingenious, compact and sturdy grinders are saving and making money for their owners all over the world.

WARDWELL
3809 Ridge Road
Cleveland 9, Ohio

Write for Bulletin 35T

Maker of Largest Line of Saw and Tool Sharpening Machines

CIRCLE INFORM-A-GRAM KEY NO. 1654

DYKEM STEEL BLUE
Stops Losses making Dies and Templates

Popular package 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

Write for sample on company letterhead
THE DYKEM COMPANY
2303L North 11th St. • St. Louis 6, Mo.

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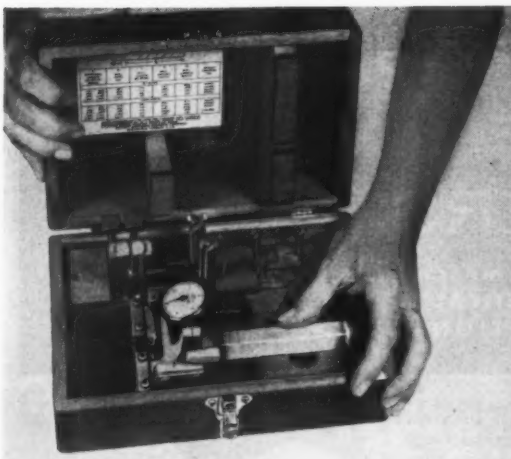
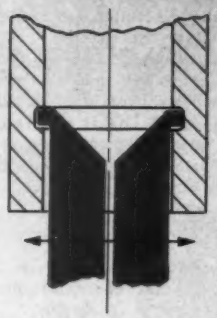


Full line contact for long segment wear.

Straight line motion guarantees accurate measurement over full range.

BRYANT GROOVE GAGE



This Kit Checks Grooves for

O-Rings — .421 to 4.870 Diameter.

Snap Rings — .267 to 5.266 Diameter.

- Line contact assures long segment life
- No bearings or sliding members to wear
- Selected Northern hardwood case
- Immediate shipment from stock

Special segments available for checking non-standard grooves, concentricity of groove to bore, or depth of groove to face.

Groove segments can also be used on the Bryant B-21 Bench Gage.

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Bryant Gage & Spindle Division

P. O. Box 620-F, SPRINGFIELD, VERMONT

Division of Bryant Chucking Grinder Company

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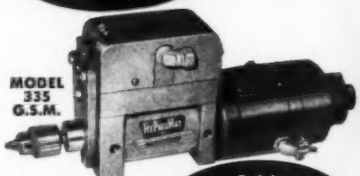
Automatic DRILLING AND TAPPING UNITS

MODEL E-300

STROKES 3½" to 25" MOTOR CAP. TO 5 H.P.

Special units to meet your unusual applications.

MODEL 335 G.S.M.



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Quick, Easy Setup Air or Hydraulic Operation.

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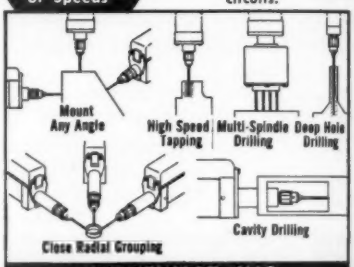
Over 25 Models Wide range of Speeds

Write Today for FREE literature showing units and circuits.



HYPNEUMAT, INC.

647 W. Virginia Street, Milwaukee, Wis.

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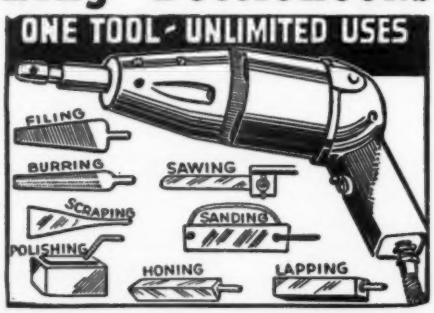
Hand Finishing Bottlenecks

WITH OUR

PORTABLE ELECTRIC RECIPROCATING TOOL

This handy tool will cut out many tedious hand filing and finishing operations — Increase Production — Produce Uniform Work.

Light in weight — Delivers 1/8" or 3/8" fixed stroke at 1000 strokes per minute — Operates on 110 volts AC or DC.



ACME TOOL COMPANY

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THE HELIOS 50 EK VERNIER CALIPER

With Automatic Thumb Lock . . . With all Inch Scales or one Inch and one Metric Scale:

$9.90

The 55 A with set screw lock with one inch and one Metric scale or all Inch scales:

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All prices F.O.B. New York

Also available . . . Dull Chrome finish calipers and Dial Indicator calipers.

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6" SCALE HARDENED Guaranteed Accuracy within .001" Double Length Vernier

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CIRCLE INFORM-A-GRAM KEY NO. 1664

Adaptability in a Wide Variety of Production Operations on tubular and solid round metal parts is one of the features of the high speed double end machine described in a catalog. This and other machines are explained along with detailed diagrams and specifications of each product. For your copy contact Walter P. Hill, Inc., 22183 Telegraph Rd., Detroit 19, or — **Circle Inform-A-Gram No. B52.**

A 4-Page Bulletin Describes the floor turntable welding positioners which range in capacities from 1,000 to 120,000 lbs. Long pipe can be placed vertically on the machine and the flange welded in a fillet. This application of the product is one of several explained in this bulletin. For copies of Bulletin FT 57, write to Aronson Machine Co., Arcade, N. Y., or — **Circle No. B53.**

A High Production General Purpose Carbide for cast iron and nonferrous materials is described in a folder. Firthite NHA has sufficient strength for fairly heavy cuts and, on lighter work, produces fine finishes even on sticky metals. Other features and specifications are also presented. Direct requests for copies of the NHA carbide folder to Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, or — **Circle No. B54.**

A Complete Line of Standard Socket Screw Products, pressure plugs, and dowel pins are offered in the revised Unbrako catalog. Major product lines reviewed are heat-treated alloy-steel and stainless-steel Unbrako socket-head cap and set screws. Advantages and applications are also presented. The catalog has been compiled by Standard Pressed Steel Co., Box 600, Jenkintown, Pa., or—**Circle Inform-A-Gram No. B55.**

Speed Installation, Provide Reliable Operation and easy maintenance with Calrod heaters. Designed for machinery manufacturers, they can be used on shrinking machinery, extruding machines, radiant ovens, and paint heaters. A catalog describes the uses of this tubular heater. For copies of Catalog GEA-5866 write to General Electric Co., Schenectady 5, N. Y., or — **Circle No. B56.**

Production of Electrical Contact, Terminal, and Conductor Assemblies by resistance welding is the subject of a catalog published by the Taylor-Winfield Corp., Warren, Ohio. All types of machines used in this line are illustrated and explanations of operation and advantages are outlined. Copies of Bulletin 8-313 may be obtained by writing the company, or—**Circle Inform-A-Gram No. B57.**

Greater Efficiency and Smoother Workflow are obtained with Feedrail moving power systems. Other advantages of these systems are outlined in a bulletin, and illustrations show possible uses of the product. The electrification systems are available in 60, 100, 225, 375 and 500 ampere capacities and are installed without any special tools. For additional information write for Bulletin 51 which is offered by Feedrail Corp., 125 Barclay St., New York 7, or — **Circle Inform-A-Gram No. B58.**

A 4-Page Illustrated Bulletin describes a line of horizontal broaching machines developed for production gun rifling. The bulletin covers design, features, and capacities of these machines and their application to specific caliber sizes. Line drawings graphically portray the construction and geometry of these tools. Contact Colonial Broach & Machine Co., P.O. Box 37, Harper Station, Detroit 13, for your copy of Bulletin GR-57, or — **Circle Inform-A-Gram No. B59.**

And here's what it means to you!

Recent tests in drilling 16,300 holes show that there is a difference in bushings. In these tests Ex-Cell-O Bushings lasted twice as long as competitive makes.

These differences make Ex-Cell-O a leader: (1) High chrome, high carbon oil-hardening bearing steel, (2) uniform heat treating to 62-64 Rockwell "C". (3) Precision grinding of inside and outside diameters and under the head for perfect seating. (4) Ex-Cell-O's own standards for precision, tougher than A.S.A. standards.

Large inventories in Detroit, New York, Downey, Cal., Lima, Ohio, and London, Canada, keep your inventory down. You get immediate shipment. Write for an Ex-Cell-O Drill Jig Bushing Catalog today.

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN
EX-CELL-O FOR PRECISION
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MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • TORQUE ACTUATORS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

CIRCLE INFORM-A-GRAM KEY NO. 167

Custom Comparator Charts and Coordinated Staging Fixtures for rapid and highly accurate part inspection on optical comparators is outlined in a catalog. For users of automated machine tools is the illustration of an aircraft fuel control cam manufactured on a Gorton Pantograph. To assure positive tooling coordination, both pantograph follower template and Magni-gage comparator chart are photographic reductions from a single precision master layout. Copies of the catalog may be obtained from The Industrial Lofting and Mfg. Co., Inc., Bridgeport 7, Conn., or — **Circle No. B60.**

A Series of Portable Industrial X-Ray Equipment is pictured and outlined in a folder released by Mitchell Radiation Products Corp., 128 E. Washington St., Norristown, Pa. They provide high accuracy for radiographic inspection of castings, welds, assemblies, and facilitates improvements and repairs on metal products. The three units of the MS series have built in high tension transformers, simplified, and color-coded technique charts on the face of the control panels. For further information write to the company for the folder, or —
Circle Inform-A-Gram No. B61.

LEMPCO STYLE "M" and "L" DIE SETS
NEW
ALL-STEEL
DIE SETS AT THE PRICE OF
CAST IRON!
BALL-BEARING ANTI-FRICTION PIN BUSHINGS
EASIEST AND FASTEST TO ASSEMBLE OR DISASSEMBLE
PRECISE ALIGNMENT FOR MILLIONS OF STROKES
ZERO MAINTENANCE; ONLY CUP GREASE AT GRINDING TIME
NOW, Lempco's line of Precision Ball-Bearing Die Sets, includes new low-priced all-steel sets, Style "M" and "L", at the price level of friction-type cast iron die sets. Better write TODAY for New Low Prices!
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INDUSTRIAL, INC.
DUNHAM RD., BEDFORD, OHIO
WHERE QUALITY CONTROLS!
CIRCLE INFORM-A-GRAM KEY NO. 168

Save Time and Space for Stores, Warehouses, and Factories with portable conveyors with the Quick-Eez coupling features. A folder describes this feature and graphically presents the advantages. Both ends of the conveyor are identical and each section is independent of adjoining ones. This folder is made available by the E. W. Buschman Co., Clifton and Spring Avenues, Cincinnati 32, Ohio, or —
Circle Inform-A-Gram No. B62.

Lock Threaded Fasteners with Loctite Sealant. The product is completely discussed in a booklet, and specific uses and methods of application are documented for studs, screws, nuts, and other threaded products. Information on techniques for sealing and soldering sleeve joints is accompanied by pictures and diagrams. Copies of Technical Report 5 are issued by American Sealants Co., 103 Woodbine St., Hartford 6, Conn., or—**Circle Inform-A-Gram No. B63.**

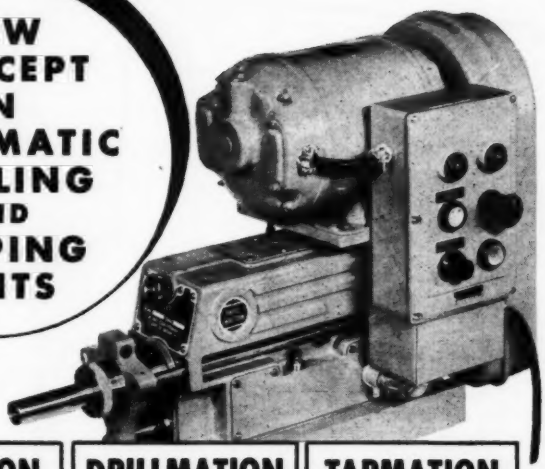
More Than 20 Different Types of Carbon, alloy and stainless steels are described in a revised bulletin. Each is designed for maximum output of machined parts in keeping with other individual characteristics. Featured are the fast machining leaded steels. Both free cutting bar and plate steels are included in this selection guide. For copies of Bulletin 99-1 contact Joseph T. Ryerson & Son, Inc., Box 8000-A, Chicago 80, or—**Circle Inform-A-Gram No. B64.**

A 4-Page Brochure Illustrating the Type K Pneumatic Friction Clutch and Brake Unit has been released by E. W. Bliss Co., Canton, Ohio. The brochure explains the features of the single disc press clutch and other points of this unit. Among these features are the positive engagement and disengagement, cycle-welding, and ease of maintenance. A large cutaway illustration shows the inner workings of the clutch, which can be either outboard mounted or crankshaft mounted. Write to the company for Bulletin 37-A, or —
Circle Inform-A-Gram No. B65.

Semspak, a Portable and Automatic Screw Driver, is highlighted in an illustrated catalog. It drives screws rapidly from any angle, and holds screws tight until firmly started in workpieces. The nose piece is propelled forward with the screw positioned properly for easy, positive screw placement. The visible load cartridge feeds screws automatically but will not shoot screws. Copies of the catalog are prepared by Shakeproof Division, Illinois Tool Works, 2501 N. Keeler Ave., Chicago 39, or —
Circle Inform-A-Gram No. B66.

FOR THE "HOLE" FIELD

NEW CONCEPT IN AUTOMATIC DRILLING AND TAPPING UNITS



MODEL 500
DULL TOOL LITE
AND
SUB-BASE

AUTOMATION | **DRILLMATION** | **TAPMATION**

Drillmation's hydraulic, locked-circuit feed Drilling and Tapping Units are the finest and most completely self-contained of any similar unit available today. Drillmation also offers more essential and exclusive features. Write TODAY for literature.

12 ESSENTIAL Exclusive FEATURES in 1 Unit

- **DULL TOOL CONTROL** Unit will withdraw tool from work and indicate to operator when tool becomes dull.
- **RAPID TOOL CHANGE** Tool may be replaced without changing the controls.
- **UNIFORM TIME CYCLE** Maintains comparatively constant time cycle even when tools become dull.
- **SELF-CONTAINED HYDRAULIC SYSTEM** Delivers only the oil pressure required to overcome machining resistance.
- **COMPLETELY AUTOMATIC** Enclosed electric controls. Unit is "Fail Safe".
- **THRUST CONTROL** Maximum thrust may be set to protect tools. Will not surge at break point.
- **FEED CONTROL** Infinitely variable and positive feed rate.
- **RAPID APPROACH AND RETURN** Variable irrespective of RPM.
- **MICRO DEPTH CONTROL** Depth will repeat within .0005 inch.
- **EMERGENCY QUILL RETURN** Button on front of unit. Aid in setting tools.
- **COOL OPERATION** Low volume high pressure hydraulic pump used on power stroke only. Air power used for rapid traverse.
- **PRODUCTION MACHINE** Mount in any position. Quiet operation. Self lubricating.

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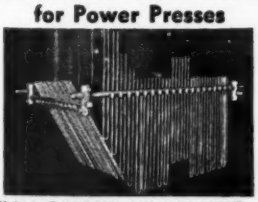
CIRCLE INFORM-A-GRAM KEY NO. 1691

ADJUSTABLE ROD GUARD
for Power Presses



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249 Sheffield Ave. • BROOKLYN 7, N. Y.

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To Your Specifications

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— Except Screw Machine Cams —

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Design Assistance Offered

KIDDE PRECISION TOOL CORPORATION
10 Locust Ave., Roseland, N. J.

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HOLD IT!

FIRMLY BUT GENTLY

WITH WOODWORTH CHUCKING EQUIPMENT

Our tough looking character who is holding the little bird clearly demonstrates one fact whenever you are holding anything it should be secured with gentle firmness. And this is so true when considering chucking equipment.

Your best machine will produce only as accurately as its work-holding device permits and Woodworth manufactures the most rugged, accurate and dependable chucks for precision machining in America.

We invite your inspection and consideration of N. A. Woodworth products. There is a Woodworth Sales Representative in your area and a letter to the N. A. Woodworth Company will place him promptly at your service.

"Accuracy you can trust"

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1300 East Nine Mile Road
Detroit 20, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 1694

*CERTIFIED . . . "up to 3,450 lbs. of clamping force"

THE JAMES H. HERRON CO.
LABORATORIES
Testing · Analysis · Inspection · Soil Investigation · Non Destructive Testing
1360-1364 WEST THIRD STREET
CLEVELAND 13, OHIO
MAIN 1-5443

May 11, 1956

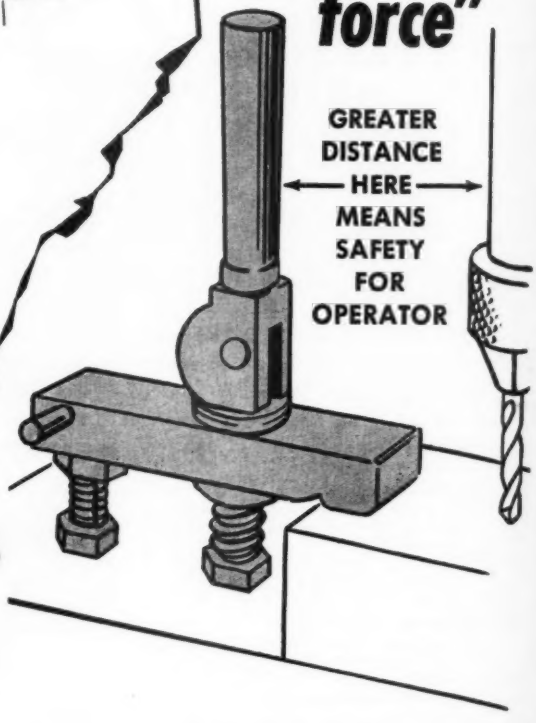
The Standard Parts Company
1000 Broadway
Bedford, Ohio

Re: Our Order N-7281

Gentlemen:

With reference to the Double Cam-Lever (500) and Eye-Bolt (500), we have conducted experiments to determine the amount of clamping force a man can exert with this device, lubricated.

Without the use of any auxiliary equipment, it was found that a man could exert up to 3,450 pounds, by bringing the lever to a position 90° with the Eye-Bolt.



with

STANDARD'S DOUBLE ½" (500) CAM LEVER

This Double Cam Lever offers superior design and engineering features—assuring greater safety, performance, strength and durability.

- **Maximum Job Clearance.**
- **Safe Operation—with handle *vertical* before clamping (as illustrated).**
- **Constant Maximum Clamping Pressure—perpendicular to center line of lever.**
- **Certified 6-Ton Back-Pressure Resistance—no danger of cam backing up.**
- **Ready to Use—no altering needed on assembly.**
- **No Lever Breakage—solid steel handle.**
- **This cam can be applied to your specially designed assemblies. Quotations on request.**

If it's a Standard Part, you know it's GOOD!

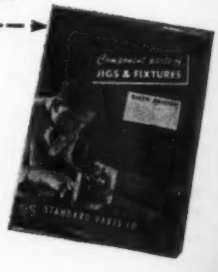
OVER 500 OTHER STANDARD JIG AND FIXTURE COMPONENTS

Standard Parts Company offers the most complete line of fine quality tool room standards available today. All Standard components incorporate the latest safety, efficiency and performance features desired by the trade... as typified by the Double Cam Lever shown on this page.

You can depend on Standard Components... they will never let you down (with down-time and work stoppages). Our New Sixth Edition CATALOG—covering our complete line—is now ready for you. Tracing sheets are available.

Write for New Sixth Edition
FREE CATALOG---→

56 pages



Manufacturers of GENUINE NOBLE & STANTON Parts

STANDARD PARTS CO.

1002 BROADWAY, BEDFORD, OHIO • TWX BEDFORD, O. 462

CIRCLE INFORM-A-GRAM KEY NO. 170

INFORM-A-GRAM

SEPTEMBER 1957 ISSUE

DO NOT USE THIS CARD AFTER NOV. 30, 1957

TOOLING and PRODUCTION:

Please have information on items circled sent to me.

YOUR NAME _____ YOUR TITLE _____
(Please Print or Typewrite)

COMPANY NAME _____

COMPANY ADDRESS _____

CITY _____ ZONE _____ STATE _____

(Please use only one of these INFORM-A-GRAM cards for yourself and let one of your associates use the other.)

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12	31	53	72	128	149	180	215	1573	1655	1776	1861	1981	2063	2165	2352	
13	32	54	105	129	150	183	217	1581	1661	1777	1862	1982	2064	2181	2361	
14	33	55	107	130	151	184	220	1582	1662	1781	1863	1983	2091	2182	2362	
15	34	56	108	131	152	187	221	1583	1663	1782	1891	1984	2092	2183	2363	
16	35	57	109	132	153	188	223	1584	1664	1783	1892	1985	2093	2191	2371	
17	38	58	110	133	155	191	224	1611	1691	1811	1893	2011	2094	2192	2372	
18	37	59	111	134	156	192	225	1612	1692	1812	1901	2012	2095	2193	2391	
19	41	60	113	135	159	195	227	1613	1693	1813	1902	2013	2101	2194	2411	

EDITORIAL ITEMS

A1	A19	A37	A35	A73	B1	B19	B37	B55	C7
A2	A20	A38	A56	A74	B2	B20	B38	B56	C8
A3	A21	A39	A57	A75	B3	B21	B39	B57	C9
A4	A22	A40	A58	A76	B4	B22	B40	B58	C10
A5	A23	A41	A59	A77	B5	B23	B41	B59	C11
A6	A24	A42	A60	A78	B6	B24	B42	B60	D1
A7	A25	A43	A61	A79	B7	B25	B43	B61	F1
A8	A26	A44	A62	A80	B8	B26	B44	B62	F2
A9	A27	A45	A63	A81	B9	B27	B45	B63	F3
A10	A28	A46	A64	A82	B10	B28	B46	B64	F4
A11	A29	A47	A65	A83	B11	B29	B47	B65	F5
A12	A30	A48	A66	A84	B12	B30	B48	B66	F6
A13	A31	A49	A67	A85	B13	B31	B49	C1	F7
A14	A32	A50	A68	A86	B14	B32	B50	C2	F8
A15	A33	A51	A69	A87	B15	B33	B51	C3	F9
A16	A34	A52	A70	A88	B16	B34	B52	C4	F10
A17	A35	A53	A71	A89	B17	B35	B53	C5	
A18	A36	A54	A72	A90	B18	B36	B54	C6	

Which article in this issue was of most interest to you? _____

THESE INFORM-A-GRAM CARDS are for the convenience of *TOOLING and PRODUCTION* readers who, we know, rarely have stenographic help at their beck-and-call while reading. To get further information concerning selected items featured — all one needs is an INFORM-A-GRAM card and a pencil or pen to circle the numbers of the items wanted. If there is no identifying number, use the page number.

Our reader service department is handling over 100,000 reader inquiries per year and it is essential that the blanks at the top of each card be filled in accurately and completely. Please use only one of these INFORM-A-GRAM cards for yourself and let one of your associates use the other.

INFORM-A-GRAM

SEPTEMBER 1957 ISSUE

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5	24	46	64	119	140	167	203	243	1623	1743	1822	1933	2024	2122	2321	2423
6	25	47	65	120	141	168	204	244	1624	1744	1823	1941	2051	2123	2322	2424
7	26	48	66	121	142	170	207	1541	1625	1771	1851	1942	2052	2124	2323	
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9	28	50	68	125	145	175	211	1543	1652	1773	1853	1971	2054	2162	2332	
10	29	51	69	126	147	176	213	1571	1653	1774	1854	1972	2061	2163	2333	
11	30	52	70	127	148	179	214	1572	1654	1775	1855	1973	2062	2164	2351	
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A10	A28	A46	A64	A82	B10	B28	B46	B64	F4
A11	A29	A47	A65	A83	B11	B29	B47	B65	F5
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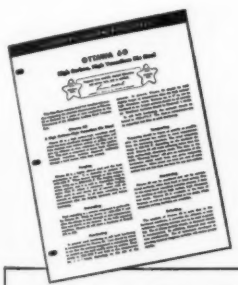
These OTTAWA 60 DIES PAYOFF BIG IN 3 WAYS

- ★ Buffing Time Reduced ½
- ★ Rejects Reduced 20%
- ★ Stoning and Regrinding of Dies Reduced 75%



Write for BLUE SHEET on OTTAWA 60

This concise four-page folder gives all needed handling and shop treatment details on Ottawa 60. Included is certified laboratory information on physical characteristics, and complete data on forging, annealing, hardening, tempering, etc. *Ask for your copy.*

ADDRESS DEPT. TP-93

WSW 6648

One way to increase profits is to reduce finishing costs. That's what a fabricator of hearing aid cases accomplished when he switched from regular die steel to A-L's air hardening Ottawa 60 high carbon-high vanadium grade.

Ottawa 60 dies produced stainless steel cases which were free from galling and scoring—were nearly perfect as they came out of the dies. Less than half the previous buffing time was needed to bring them to the required high finish. Rejects—which ran about 20 percent before the use of Ottawa 60—were reduced almost to the point of elimination. Also, the new Ottawa 60 dies required stoning and regrinding only a quarter as often as the standard tool steel dies they replaced.

This same manufacturer has passed along significant savings to other customers through the use of Ottawa 60. By practically eliminating rejects due to corner cracking and scoring, customers receive better stamped parts at lower per-piece cost.

Let us show how you, too, can save with A-L tool steels and, at the same time, furnish your customers a better product.

Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pa.

For nearest representative, consult Yellow Section of your telephone book.

For complete **MODERN** Tooling, call

Allegheny Ludlum

AL® FINE TOOL STEELS SINCE 1854

CIRCLE INFORM-A-GRAM KEY NO. 171

PRODUCTS

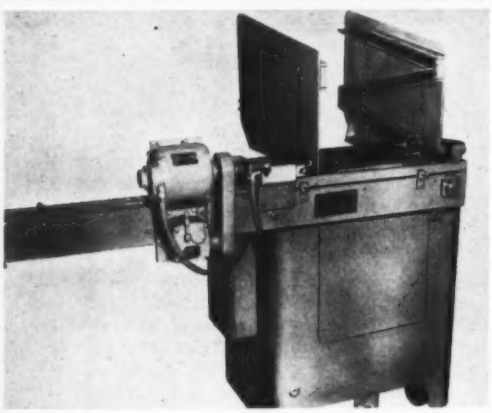
NEW DEVELOPMENTS · IMPROVEMENTS · COST AND TIME SAVERS

SPINDLES . . .

The development of the spiral-flow design of the housing enclosing the motor parts is a feature of this spindle. The spiral flow of this liquid cooled design maintains a temperature rise as recommended for efficient motor performance. The Standard Electrical Tool Co., Mt. Hope & Sixth Sts., Cincinnati 4, or — **Circle No. A1.**

ELECTRONIC GAGE . . .

The Versachek converts minute differences in established dimensions into voltage changes and amplifies them for reading on a meter scale by means of electronic circuitry. Four magnifications are available on the standard unit and these can be selected quickly by a switch on the front panel. The Taft-Peirce Mfg. Co., Woonsocket, R. I., or — **Circle No. A2.**



BAR — TUBE FEEDER . . .

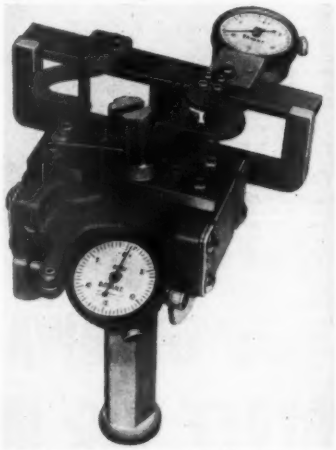
Non-stop production and automatic feeding from a conveyor line into a grinding machine are provided by the Model 1700B bar and tube feeder. The unit has a magazine loading feed with any desired constant rate of 5 to 20 fpm from the loader to the machine. Feedall, Inc., 38399 Pelton Rd., Willoughby, O., or—**Circle No. A3.**

CHIP REMOVER . . .

Remove chips from blind holes by use of a magnetic chip remover. It consists of a permanent magnet fitted into a knurled aluminum holder and made in various sizes starting at ⅛" dia. It does not scatter chips as when using an air blast remover. Heimann Mfg. Co., Urbana, O., or —**Circle No. A4.**

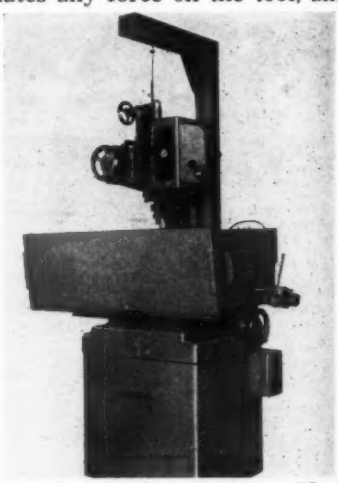
CHECK FACE SQUARENESS . . .

A face, shoulder, or counterbore can be checked for squareness in relation to a thread during machining as well as at inspection. This attachment was developed for the P-21 portable internal thread gage. Bryant Gage and Spindle Div'n, Box 620, Springfield, Vt., or — **Circle Inform-A-Gram No. A5.**



MACHINE METAL . . .

Any metal regardless of hardness or density can be machined by the M501 DieMatic. Machined by electrical energy, it eliminates any force on the tool, and burred or feathered edges. Used to make forging, die casting, blanking, extruding, etc. dies. Elox Corp. of Mich., 1830 N. Stephenson Hwy., Royal Oak 3, Mich., or — **Circle Inform-A-Gram No. A6.**

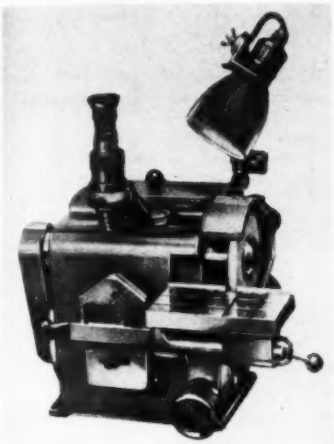


ON PARADE

Mail FREE Inform-A-Gram Card for MORE Details.

DRILL GRINDER . . .

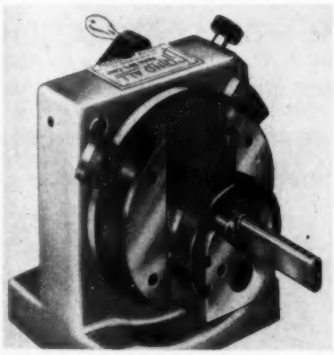
Use this drill grinding machine for drills 0.012″ to 0.120″. It clamps into the holder which accommodates the machine's diameter range and is checked under



a microscope. The shape of the holder assures the absolute symmetrical sharpenings of the drill. Jersey Mfg. Co., 456 Livingston St., Elizabeth, N. J., or —
Circle Inform-A-Gram No. A7.

GRIND-ALL FIXTURES . . .

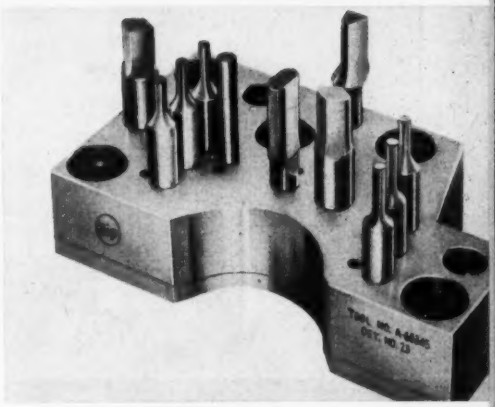
Easily grind irregular shaped perforators concentric with shank within ±0.0002 accuracy with the Grind-All fixture. It can also be used for light milling and



boring, radius dressing, and as an inspection tool. It features hand crank for easy rotation of the index plate and a single locking screw. Harig Mfg. Corp., 5757 W. Howard St., Chicago 31, or —
Circle Inform-A-Gram No. A8.

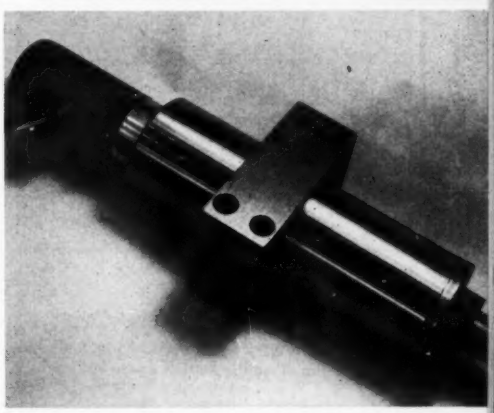
RETAINER PLATES . . .

For close mounting on interchangeable punches and die buttons use retainer plates. They incorporate a ball lock feature for quick insertion and release of each punch or die button. They also enable use of one die for production of more than one part. Acme Industrial Products, Inc., P. O. Box 468, Royal Oak, Mich., or —
Circle No. A9.



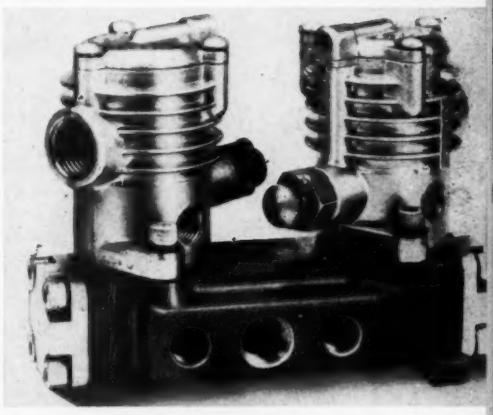
POWER FIXTURE CLAMP . . .

Used for clamping, locating, or push-off of parts on production operations, is the Valve-N-Cylinder. The unit consists of a square rod (nonrotating) air cylinder on which is mounted an electric three-way valve. It is available with 1″ to 2″ bores and 1″ to 4″ strokes. Beckett-Harcum Co., 1087 Wayne Rd., Wilmington, O., or —
Circle No. A10.



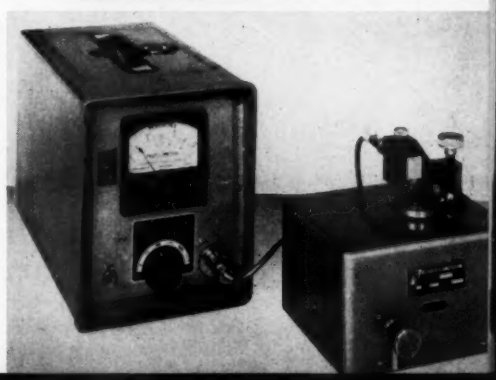
CONTROL VALVES . . .

Designed for control of smaller devices and available in both single and double solenoid types is a line of Speed King ¼″ foot-mounted 4-way control valves. The valves feature aluminum bodies, end caps, spacers and piston, with hard chrome plated stainless steel stem. Valvair Corp., 454 Morgan Ave., Akron, O., or —
Circle No. A11.

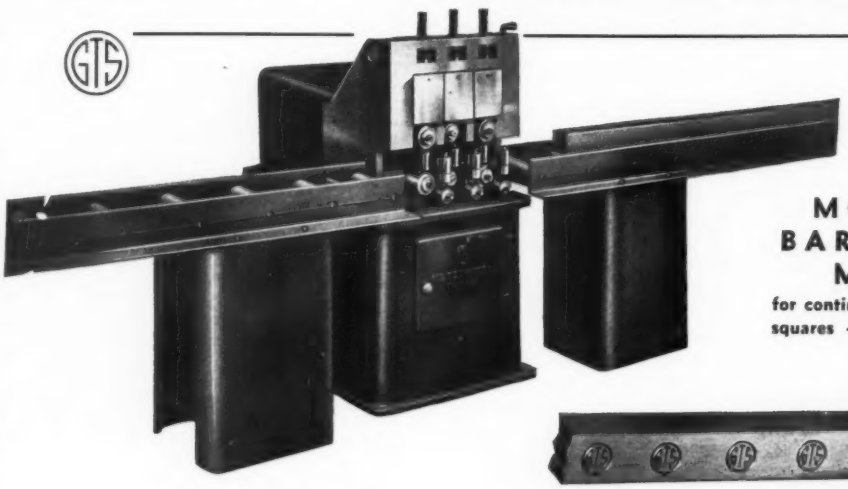


ROTARY PILOTOR . . .

Measure surface roughness of concentric diameters on flat surfaces with the Profilometer rotary table pilotor. This new unit accommodates a wide range of parts, and during operation, the tracer remains stationary while the table rotates. Micrometrical Mfg. Co., 345 S. Main St., Ann Arbor, Mich., or —
Circle No. A12.



Precision . . . Speed . . . Versatility



MODEL 295
BAR MARKING
MACHINE

for continuous marking on flats — squares — rounds — octagonals

Simple horizontal and vertical adjustments on this unit fix the work for precision operation. Bars may be marked on one side only or on opposite faces. Intermittent marking is obtainable at desired intervals up to 9 in. Lettering knurls can be quickly changed by removing a single screw. Feed and discharge roller bearing tables are available with the unit.
Write today for full information on Model 295, or any part of the famous GTS line of marking equipment.

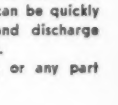
GEO. T. SCHMIDT, INC.
4112 Ravenswood Avenue
Chicago 13, Illinois

If it's Worth Making, It's Worth Marking.

CIRCLE INFORM-A-GRAM KEY NO. 1741

SOUTH BEND 14½" LATHES take tolerances in their stride. Their accuracy, smoothness and operating ease save time on the tough jobs as well as the routine ones. With proper tooling, work can often be machined with such precision and smoothness that subsequent grinding, honing or lapping operations may be eliminated. Dollar-for-dollar you get more in South Bend Lathes . . . Write for catalog now and find out how South Bend Lathes can lower your machining costs.

Accuracy to keep machining economical!



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Also METAL PRODUCTION CAPACITY

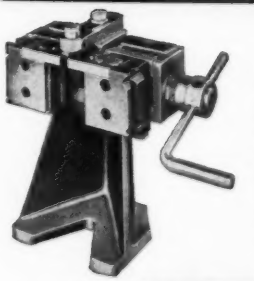
• For long or short production runs of large or small parts. Complete facilities including Profilometer Duplicators, Presses up to 450 tons, Planers up to 20 ft. stroke, Radial Drill Presses up to 8 ft., Lathes up to 158" c. c., Boring Mills up to 120" bed, Milling Machines, Grinders, etc.

Inquiries invited on individual or contract basis.

PIVOT PUNCH & DIE CORPORATION
North Tonawanda, N. Y. Phone JA 1200

CIRCLE INFORM-A-GRAM KEY NO. 1743

SPEED UP DRILLING & TAPPING JOBS!



JOHN'S DRILL JIG

For cross or end drilling round, hexagon, or square stock or standard or odd-shaped rough castings from ⅛" to 8" O.D. Will cut tooling and production costs to minimum—10 to 100,000 pieces.

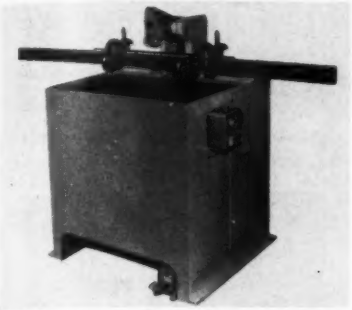
Standard removable slip fit bushings and holders available to drill center or mean off-center. The self-centering action will hold within .0015" or better regardless of jig wear or piece part O.D. variation. Jigs available in three sizes 6", 8", 14"; jaw openings 2", 3¼", 7½".

Write for complete information.

HEUSER MANUFACTURING CO.
1642 N. PAULINA ST., CHICAGO 22, ILLINOIS

CIRCLE INFORM-A-GRAM KEY NO. 1744

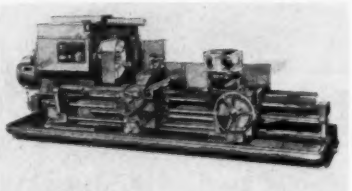
Precision Straightening, Assembling, and Cold Riveting are performed by a new series of air or hydraulic, desk-type production presses. The horizontal design assures easier hand or automatic loading and un-



loading, particularly from overhead. The 10 and 20-ton presses are ideal for automated production line use. Single (shown) or multiple heads are available. General Mfg. Co., Detroit 11, or —

Circle Inform-A-Gram No. A13.

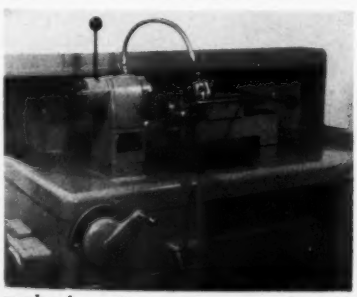
The 36" Swing 5-A Machine has been added to the line of extra heavy-duty saddle type turret lathes by The Warner & Swasey Co., 5701 Carnegie Ave., Cleveland, Ohio. Designed for precision, high production



metal turning on large size workpieces, this lathe features a 75-hp, 2-speed main drive motor and an automatic, hydraulic-shift preselector headstock. This combination provides 28 turning speeds from 10 rpm to 280 rpm.

Circle Inform-A-Gram No. A14.

½" Capacity Is One of the features of the Model A Lathe mounted on a steel cabinet manufactured by F. W. Derbyshire, Inc., Waltham, Mass. This unit is built for light instrument

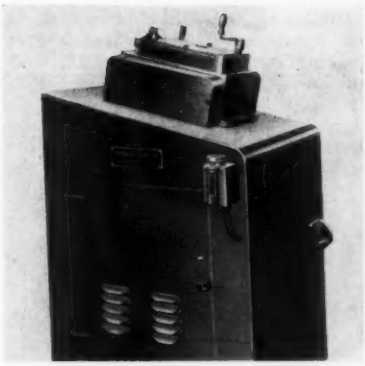


work where fine parts are made, and it will handle many different second operations. The bed length is 22" and the top surface 48" x 21".

Circle Inform-A-Gram No. A15.

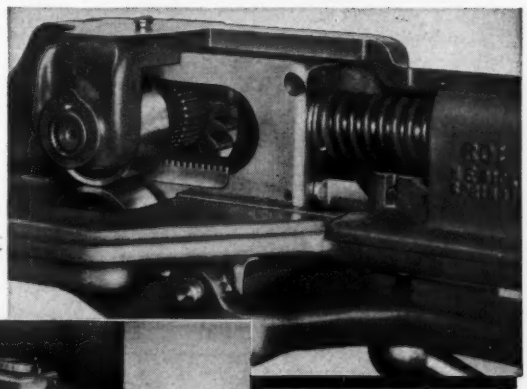
Obtain Maximum Flatness in Small Metal Stampings with this straightener. It will bring to extreme flatness (to within 0.001 to 0.002 in most cases) parts as thin as 0.010 and as short as 2" on the 6" stock width model. A single two-joint adjustment easily applies and sets the pressure to the top bank of rolls. They have variable speed drives and reverse switches. Cooper Weymouth, Inc., 600 Honeyspot Rd., Stratford, Conn.

Circle Inform-A-Gram No. A16.

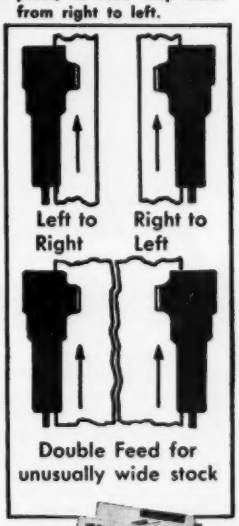


Big Feeds...Big Production...Big Profits...

at SMALL COST!....



Dickerman 12" Rol-Di-Feed, conventionally mounted on the bolster of a punch press, to feed strip stock from right to left.



Here's a new, versatile feed designed to outperform others costing up to 8 times more! The Dickerman 12" Rol-Di-Feed is easily installed on any punch press. This new feed handles with equal ease such different materials as paper, plastic, or cold rolled steel—in thicknesses ranging from .003" to 3/16" in any type of die—piercing, blanking, compound, progressive or draw. The 12" Rol-Di-Feed feeds on the press upstroke and on the downstroke, permitting accurate stock feeds up to 12" per cycle.

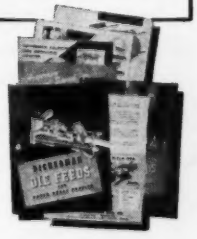
Open side design accommodates stock of almost any width. 12" Rol-Di-Feed can be mounted to feed in any direction . . . or installed in pairs to handle unusual sizes and types of stock. For greater production and profits, eliminate costly "special" feeds—install the new standard Dickerman 12" Rol-Di-Feed on all your press equipment!

Dickerman

H. E. DICKERMAN MFG. CO.

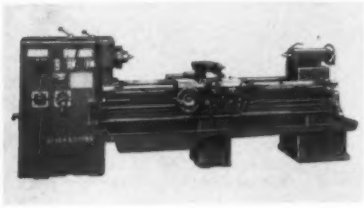
321-309 Albany Street • Springfield, Mass.

Send today for literature on the complete Dickerman line.

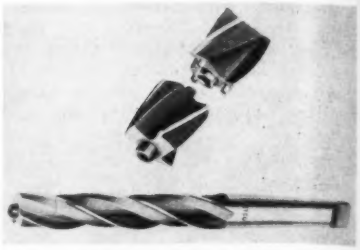


CIRCLE INFORM-A-GRAM KEY NO. 175

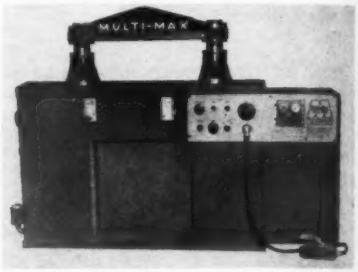
Designed to Give Dimensions of 25" maximum swing clearance over bed and carriage wings, and 16" over the cross slide is the CB2-2516 Lathe. One of the features is the headstock design. The back gear shaft and gears are located in front of the spindle to neutralize the effect of the tool life under heavy cuts. Spindle speeds are available up to 15 rpm. The Boye & Emmes Machine Tool Co., 81 Caldwell Dr., Hartwell, Cincinnati 16.
Circle Inform-A-Gram No. A17.



A New Line of Metcut Pin-Mount Two-Piece Core Drills are available in 21 small sizes from ¾" to 1⅜". Precision ground mating surfaces provide flush fit, and eliminate normal gap between body of the tool and cutter section, leaving no space for chips to lodge or pack. The cutter can be easily removed from holder without taking the tool from spindle and without destroying the setup. Metal Cutting Tools, Inc., 301 S. Water St., Rockford, Ill.
Circle Inform-A-Gram No. A18.



The Redesigned Multi-Max Punch Press features 40 to 125-ton capacity. It is available in 2 and 4-post models with speeds of from 40 to 1000 spm; bolster and ram areas from 2' x 2' to 4' x 12' unlimited shut die height.



Material can be fed from front to back, back to front, and side to side. In the event of a power failure, the machine automatically "fails safe." Diamond Machine Tool Corp., Pico, Calif.
Circle Inform-A-Gram No. A19.

Black Granite-Diorite Surface Plates feature extreme density and stability. Other qualities of Valu-Plates include non-magnetism, hard non-abrasive surface lapped to an over-all accuracy of 0.0002" and longer useful life. They are available in four sizes: 8" x 12", 12" x 18", 18" x 24", and 24" x 36". The DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Circle Inform-A-Gram No. A20.

HEVI DUTY TOOL ROOM COMBINATION FOR ALL HEAT TREATING OPERATIONS

This low cost combination consists of the "TEMPERITE" Air Draw Tempering Furnace, maximum temperature 1350° F.; "TREET-ALL" Multi-purpose Furnace, maximum 1850° F.; "SPEED TREET" High Temperature Furnace, maximum 2600° F.; and an "ATMO-GEN" atmosphere generator used to supply a protective atmosphere to the above furnaces. Furnaces and "Atmo-Gen" are available separately. Send for Bulletin HD 1147.

HEVI DUTY ELECTRIC COMPANY
HEAT TREATING FURNACES HEVI DUTY ELECTRIC EXCLUSIVELY
DRY TYPE TRANSFORMERS — CONSTANT CURRENT REGULATORS
MILWAUKEE 1, WISCONSIN

CIRCLE INFORM-A-GRAM KEY NO. 176

THINK of it!

NOW you can have a boring head that will **BORE, FACE, TURN** and **GROOVE** at no higher cost than you would pay for an ordinary, single purpose boring head.

THINK

This over before buying that NEW head!!

A Boring Head That Won't Face is NOT Complete

Models for Any Size Machine

Write today for full details

CHANDLER TOOL COMPANY

MUNCIE, INDIANA

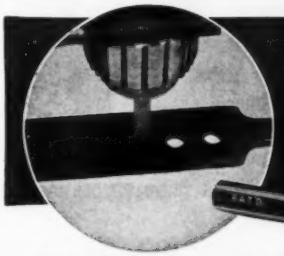
Model "D"

Chandler-Duplex

COMBINED BORING AND FACING TOOLHEADS

CIRCLE INFORM-A-GRAM KEY NO. 1771

Drill Hardened Steels without Annealing—



USE The New IMPROVED "HARDSTEEL" DRILL

With the new, improved "HARDSTEEL" Drill, you can do accurate, smooth drilling, countersinking, counterboring and reaming in steels hardened by any process without first annealing the work. And they work with equal ease on work-hardening steels and high carbon—high chrome steels of any degree of hardness.

"HARDSTEEL" Drills fit standard drill presses. They save time and reduce rejects. They permit engineering changes requiring additional drilling after hardening. And parts drilled after hardening always match at assembly.

Write for a copy of the "HARDSTEEL" Operators Manual showing how "HARDSTEEL" drills are cutting costs in thousands of plants.

You Harden It—We'll Drill It— With "HARDSTEEL"

BLACK DRILL COMPANY, INC.

1368 East 222nd St. • Cleveland 17, Ohio

"HARDSTEEL"

CIRCLE INFORM-A-GRAM KEY NO. 1772

You Need an Extra Hand Now to Speed Up Production!

HEIMANN TRANSFER SCREW SETS

IN 11 SIZES No. 6 to 1" N.C. In all S. A. E. sizes.

Here is the *faster*, more precise way of transferring open and blind screw holes—make savings in "wage-dollars-per hour" of your expensive hands on every job. A die-and-tool maker's tool with many other applications for die makers and machinists. A set of 6 Hardened Screws nested in combination holder and wrench —no other tools needed. Get more work *now*—save money too!

HEIMANN MFG., CO. • URBANA, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 1773

PRESSURELOK-224

the best diamond wheel ever developed for carbide tool grinding. Guaranteed ultimate cutting life from each diamond particle in every wheel.

UNITED STATES DIAMOND WHEEL CO.

1833 ILLINOIS AVE. AURORA, ILL.

US

IMMEDIATE DELIVERY on all wheel sizes. STRAIGHT, DISH, CUP, FLARE and MOUNTED WHEELS; HONES.

CIRCLE INFORM-A-GRAM KEY NO. 1774

Buy safe "SHUR-GRIP" drop forged HANDLES

Designed to hold 3 to 6 lb. lead hammer heads more firmly — will not slip — keeps hammer head in shape longer — makes remolding easier, quicker, surer, less expensive.

Write for circular and prices

LAWRENCE H. COOK, INC.

48 MASSASOIT AVENUE, EAST PROVIDENCE 14, R. I.

CIRCLE INFORM-A-GRAM KEY NO. 1775

FORM and PUNCH SHAPER

ECONOMICAL PUNCHES with CURVED NECKS finished completely IN ONE CHUCKING

with the

JEMCO K-150

punch shaper

- finish job in one chucking
- 30 power built-in microscope for high precision — close tolerances

EXCLUSIVE TERRITORIES OPEN

write for complete information to . . .

Jersey manufacturing company

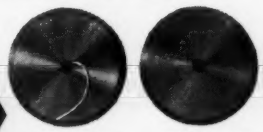
401-B LIVINGSTON ST. • ELIZABETH, N. J.

CIRCLE INFORM-A-GRAM KEY NO. 1776

NOW GET CLEAN SURFACED PARTS FROM YOUR AUTOMATICS . . . *UNMARRED* BY TOOL WITHDRAWAL MARKS

THE NEW **RELIEVOMATIC SELF-RELIEVING TOOL HOLDER**

SAVES YOU COSTLY SECONDARY FINISHING OPERATIONS



Avoid scratches like this

All clear with "Relievomatic!"

Easily installed on cross-slide or turret

Write today for details.

SILBER PRODUCTS, INC. WOrth 6-1133

134 Lafayette Street • New York 13, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 1777

ACCURACY .0002 T.I.R.

.0002 T.I.R. OR LESS AT SPINDLE NOSE, .0005 T.I.R. OR LESS ON TEST ARBOR SIX INCHES FROM SPINDLE NOSE

SPINDLE SPEEDS 150 and 250 RPM Other Spindle Speed Pulleys Available

MODEL B943 MOTOR DRIVEN WORK HEAD

No. 11 B & S Tapered Spindle Standard Equipment. No. 12 B & S or No. 5 Morse Available at Slight Extra Cost. Same Accuracy Guaranteed!

The B943 Motor Driven Work Head is a compact self-contained power unit for internal and external grinding. It is held in position by two T-slot bolts and can be mounted at any convenient spot on the table. The swivel base, which is graduated 90° one side of center and 45° on the other, permits the Work Head to swivel full 360° if desired. Swivel base can be easily removed from head permitting units to be mounted on table without base if desired. The B943 is easily and quickly mounted on other makes of grinders.

The No. 11 B & S tapered spindle, mounted on ball bearings, is hardened and ground, and is designed to receive chucks, collet fixtures, face plates, straight or tapered sleeves, centers and like equipment. Unit is grease packed at factory and requires no service in the field for the life of the bearings. Streamlined in design, this fixture is quickly mounted and is easy for the operator to keep clean.

The special motor is provided with conveniently located reversing switch which is handy for the operator regardless of the position of the work table or rotation of the work. Motor operates quietly and is fully protected from dust and from any oil entering from working parts.

See this extremely accurate B943 work head at your equipment dealer or write for complete literature.

K. O. LEE COMPANY

ABERDEEN, SOUTH DAKOTA

CIRCLE INFORM-A-GRAM KEY NO. 1781

ACTUAL SIZE

Conversion to NYLON-GEAR BY SMALL-LOT MOLDING PROCESS

ACTUAL SIZE

SAVES 26¢ PER UNIT

This Zytel 101 Nylon Beveled Gear replaced a machined gear that formerly cost 59¢ each. After the initial tooling costs we die-molded it in one operation by our special injection process at 33¢ each.

COST ANALYSIS:

Tooling, set-up and first 100 pieces, including material and trimming **$286.00**

Additional 100 lots: $33.00

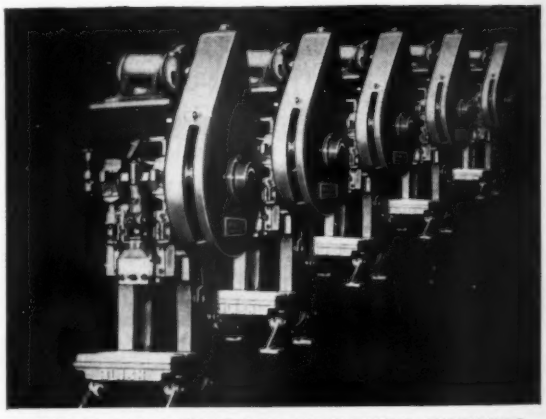
In addition to a cheaper piece price and equal wearing qualities, the Nylon Gear proved rustproof, noiseless, required no oiling and weighed less.

Let us quote on your Short-Run Plastic Moldings. We will gladly submit quotations without obligation.

DAYTON ROGERS *Manufacturing Company*

MINNEAPOLIS 7B, MINN.

CIRCLE INFORM-A-GRAM KEY NO. 1782



BLISS' ALL-NEW LINE OF BENCH PRESSES OFFERS FAMOUS BIG PRESS FEATURES

- Six models: Bench presses and adjustable bed and horn presses in up to ten ton capacity
- Split bronze bushings in frame and connection bearings
- Bliss Rolling Key Clutch—performance-proved on thousands of Bliss inclinables
- Extra long "V" type removable gibs
- Extra long slide with removable connection screw, ball seats and removable clamping caps
- Roll feeds, die slides and other accessories

SEND FOR FREE LITERATURE: BULLETIN No. 1-A

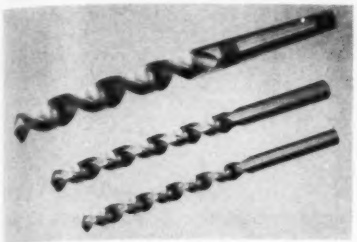
BLISS SINCE 1857

100 years of making metal work for mankind

E. W. BLISS COMPANY
1132 North Seventh St.
San Jose, California

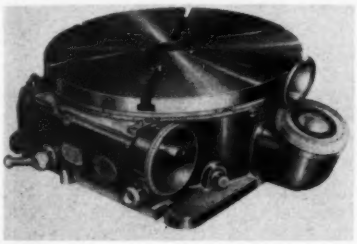
CIRCLE INFORM-A-GRAM KEY NO. 1783

A Series of High Speed Taper Length Drills featuring "Fastwist" flute construction has been announced by Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich. These tools are recommended



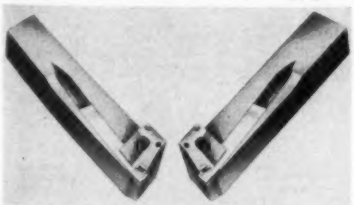
for drilling aluminum, magnesium, copper, die cast metals, some plastic materials, slate, and marble. Taper shank sizes are ⅛" to ¾". Straight shank taper length wire gage sizes 1 to 60 and straight shank taper length letter sizes A to Z.
Circle Inform-A-Gram No. A21.

For Use in The Inspection Department is the Matrix 18" optical circular table. The improved model is equipped with a 2" dia illuminated screen protected by armour plate glass, on which direct readings to 3 sec of arc are clearly visible. The



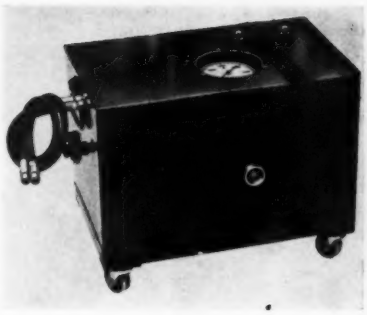
projection is accomplished by a system of lenses from a large diameter glass circle graduated in 10 min intervals. Engis Equipment Co., 431 S. Dearborn St., Chicago 5.
Circle Inform-A-Gram No. A22.

Designed for Turret Lathes is a new carbide turning toolholder. It provides a positive rake, center, and chip control. The toolholder uses a solid carbide triangular tool bit positioned for positive rake turning, per-

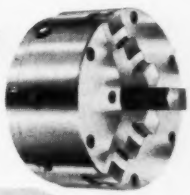


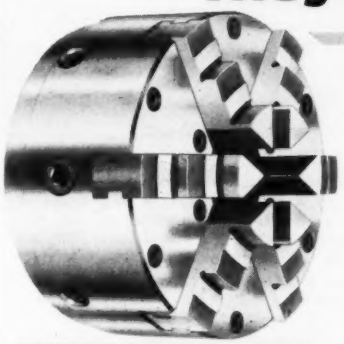
mitting greater depths of cut with decreased tool pressure. It assures up to 2" reduction on the diameter in one pass. Styles TGL and TGR are available. Everede Tool Co., 2000 N. Parkside Ave., Chicago 39. or—**Circle Inform-A-Gram No. A23.**

Designed for Varied Uses, low-cost ease of operation, and maintenance is an air-hydraulic power unit. It features a demand system with constant pressures of 3000 psi. This unit may be modified to conform to individual specifications. Standard equipment includes dial pressure gage, hydraulic hoses, two accumulators, air cleaner lubricator, filter-vented cap, and a reservoir. Hi-shear Rivet Tool Co., 2600 W. 247th St., Torrance, Calif.
Circle Inform-A-Gram No. A24.



Next time you buy scroll chucks . . . get these *Buck* features. They cost no more.





Dead true precision adjustment *within 1 minute* . . . guaranteed precision of .0005" chucking duplicate parts *without* adjustment . . . compensation for spindle run-out . . . longer lasting accuracy! Production-wise and cost-wise you can't beat Buck Ajust-Tru values.

SIZES:
4" 5" 6" 7½"
8¼" 9" 10" 12"

MOUNTING PLATES:
American Standard A-1 and A-2; Camlock D-1; Long Taper Key Drive Type L; Threaded; plus mountings for grinders and special machines.

Buck Ajust-Tru Chucks were the *first* precision universal scroll chucks and none of the imitations provide all the Buck features that give you quick set-ups and higher production rates. That's why it pays to chuck with Buck.

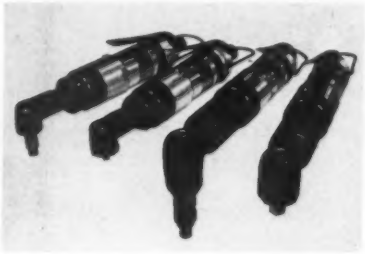
If you aren't thoroughly familiar with the Buck Ajust-Tru patented principle and why it made precision chucking possible with scroll chucks, the catalog will give you full details.

WRITE FOR COMPLETE BUCK CATALOG

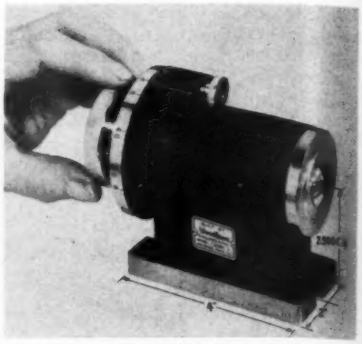
BUCK TOOL COMPANY
918 SCHIPPERS LANE • KALAMAZOO, MICH.

CIRCLE INFORM-A-GRAM KEY NO. 179

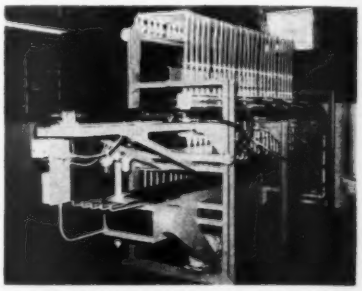
Simplify Production Fastening in Close Quarters and hard-to-reach places with a new line of angle attachments. The four new attachments are heavy- or light-duty angle screwdrivers and nutsetters. Newly designed Keller No. 2 air motors power both the new 12G-2 series screwdrivers and the 16G-2 series nutsetters. These air motors provide more speed, increased power, low noise levels, and low maintenance. Gardner-Denver Co., Quincy, Ill. **Circle Inform-A-Gram No. A25.**



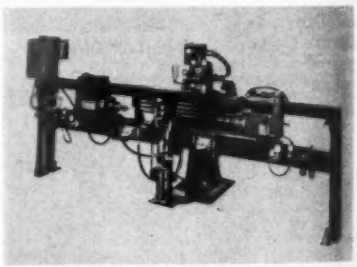
Specifically Designed for Precision Indexing is a 6-lb indexing head. It divides a complete circle into single degrees or to positive or negative angles, in single degrees, up to eight degrees on either side of each location station. This machine, which uses standard type 3C collets, is available in 48 or 40 hole indexing plates. Woodlawn Engineering Co., 2200 N. Mannheim, Melrose Park, Ill. **Circle Inform-A-Gram No. A26.**



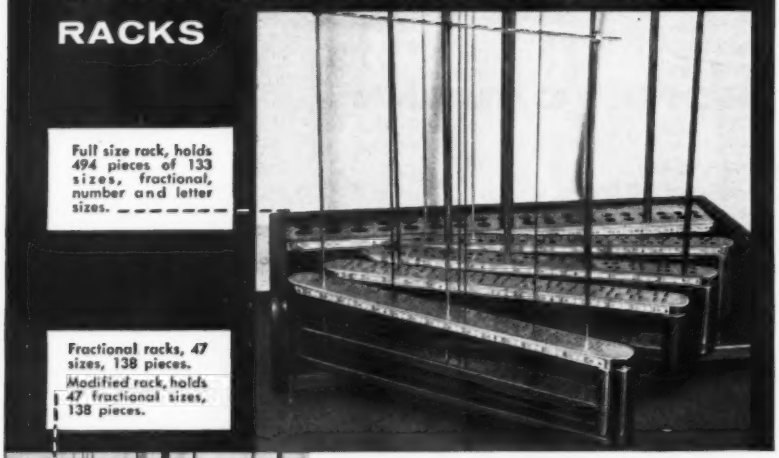
A New Heating Unit has been designed for heating the centers of T-shaped heavy duty chain attachment blanks prior to making a right-angle band. It will handle blanks of up to ⅝" thick steel and 12" wide. Production is 150 units/hr. The unit can be set up to handle a variety of blank sizes and thicknesses. Gas Appliance Service, Inc., 1940 W. Balmoral Ave., Chicago, or — **Circle Inform-A-Gram No. A27.**

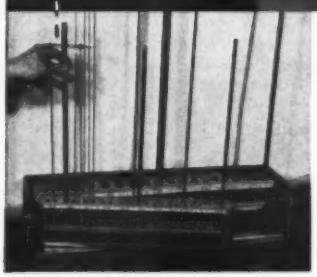


Automatically Debur and Cut Straight, Tapered, and Step Metal Tubes with a new cutoff machine. Model 3D cuts a minimum of 5,000 tubes that are tapered from the middle, producing a total of 10,000 or more, tapered legs a day. Both drilling heads are adjustable for tubes from 9" to 36" and 1" to 1½" dia. The machine can be set for center or off-center cuts. Continental Machine Co., 1952 N. Maud Ave., Chicago 14, or—**Circle Inform-A-Gram No. A28.**



SAVE TIME AND MONEY 3 WAYS WITH ACRO DRILL ROD RACKS


Full size rack, holds 494 pieces of 133 sizes, fractional, number and letter sizes.
Fractional racks, 47 sizes, 138 pieces.
Modified rack, holds 47 fractional sizes, 138 pieces.



Eliminate trouble and waste effort with this modern method of storing drill rod. Put the Acro rack in a central location and make it simple for each mechanic to select correct rod size in a hurry. Provides a visual inventory for checking rod replacements.

ACRO DRILL ROD RACKS accommodate:
26 letter sizes, 52 pieces
47 fractional sizes, 138 pieces
60 number sizes, 304 pieces

Note: Fractional sizes graduated in 64ths from 1/32" to 1/2" and in 32nds from 1/2" to 1" included.

The Acro Drill Rod Rack saves three ways:

1. Saves time in selecting and replacing drill rod. Unnecessary individual shop trips to tool cribs for the purpose of obtaining small amounts of drill rod are eliminated.
2. Saves valuable shop space. Unique swing-gate construction confines 133 sizes, 494 individual pieces in an area of 26" long x 13½" wide. Adaptable to tool makers bench, foreman's office or any other convenient location.
3. Eliminates cost of machining large rod to smaller size due to error in replacing stock. Accuracy in selection is insured because each group of apertures is plainly marked as to size with its decimal equivalent in black numerals on a white background.

FREE DATA on these racks and other Acro time-saving products is available on request. Write for Bulletin DR-57.

ACRO METAL STAMPING CO.
336 E. RESERVOIR AVE., MILWAUKEE 12, WIS.

Prompt Service on RAYMOND Chrome Vanadium

DIE SPRINGS

STOCK OR SPECIAL SIZES

MEDIUM, MEDIUM-HEAVY, HEAVY DUTY

Distributed by leading die set manufacturers

Wide variety of hole and rod sizes, lengths and deflections. Increased fatigue life. Reduced down time. *Write for specifications and price list, and name of nearest distributor.*

RAYMOND Manufacturing Co.

DIVISION OF ASSOCIATED SPRING CORPORATION

DEPT. TP-1 CORRY, PENNA.

CIRCLE INFORM-A-GRAM KEY NO. 1811

MAN PROTECTING A BIG INVESTMENT!

The man above is making a fine, positive adjustment on an EMPCO Leveling Jack, setting the machine level . . . making certain it delivers precision performance with minimum downtime . . . minimum cost! EMPCO Jacks provide a solid, smoothly adjustable foundation for machine tools, large surface plates, automation lines, tool room and production equipment of all types.

Used together with VI-SORB Mounting Pads, EMPCO Jacks control internal and transmitted vibrations. They reduce noise, retard creepage and frequently eliminate the need for anchor bolts.

Jacks available in six styles, 25 models. Pads cut to fit. Write us about your machine installation problems.

Send Today For Descriptive Bulletin No. 100.
The Enterprise Machine Parts Corporation
2735 Jerome Avenue Detroit 12, Michigan

EMPCO LEVELING JACKS

CIRCLE INFORM-A-GRAM KEY NO. 1813

ONLY THRIFTMASTER *Universal Joint Type* DRILL HEADS have these exclusive* features

• Standard Full Ball Bearing Construction including Spindles Driving assembly is FULL BALL BEARING mounted with 3 Bearings on each spindle. Thrust load carried by radial thrust bearings.

• Standard Slip-On and Slip-Off Template Construction for accurate setting and locating spindle brackets are machined to receive slip-on and slip-off template.

6 Standard Models

Models U-608 and U-1000—Ball Bearing.

Models U-620B and U-1012B—Plain Bearing. 11/16" or ½" min. centers.

Models U-608-BS and U-1000-BS—Ball Bearing Gear Case. Plain Spindles.

Semi-Standard Heavy Duty Full Ball Bearing

½" in Cast Iron—1-7/16" min. centers 7⅛" or 9⅝" Dia.

½" in Steel—1-13/16" min. centers 7" or 9⅝" Dia.

Also larger Adaptations and Full Line of Fixed Center Drill Heads.

WRITE FOR FULL INFORMATION

THRIFTMASTER Products Corporation
A SUBSIDIARY OF THOMSON INDUSTRIES, INC.

Also Makers of DORMAN AUTOMATIC REVERSE TAPPERS

1012 N. Plum Street
Lancaster, Penna.

CIRCLE INFORM-A-GRAM KEY NO. 1812

Expanding Mandrels

Accuracy 001" - No Distortion

No Slipping - Everlasting

K. O. LEE CO.
ABERDEEN, SOUTH DAKOTA

If it's made by Lee *it's a* "Knock-Out"

CIRCLE INFORM-A-GRAM KEY NO. 1814

POSITIVE GRIP • SPEED • ADAPTABILITY

Model J

AIR-POWERED TOOLMAKERS VISE

UNIVERSAL DOUBLE SWIVEL

Can be adjusted to any position without removing work from jaws. Furnished with hardened steel jaws and brass caps. Operated by a 6" air cylinder manufactured by Yost. Control kit included with each vise consisting of foot treadle valve, quick exhaust valve and 2 lengths of coupled hose. Jaws can be pre-set to any desired opening. Vise can also be operated manually. Jaw width — 4"; jaw opening — 6"; approx. wt. — 90 lbs.

Write today for bulletin on the complete Yost line

YOST MFG. CO., Cambridge Springs, Pa.

CIRCLE INFORM-A-GRAM KEY NO. 1815

YESTERDAY'S PIONEER . . . TODAY'S LEADER

WELDON

Stub Length Double-End End Mills

Stock Items

This line of small size end mills, in both double-end and single-end, with flutes shorter than regular, provides the following advantages:

GREATER STRENGTH
LONGER TOOL LIFE
FAR LESS BREAKAGE
FASTER FEEDS

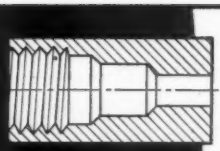
Furnished in 2- and 4-flute styles

Weldon distributors throughout U. S. A. and Canada carry complete stocks to serve you

THE WELDON TOOL COMPANY

3000 WOODHILL ROAD . . . CLEVELAND 4, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 1821



DO YOU NEED BORES LIKE THIS ?

Comet's "LOW-COST" HIGH SPEED STEEL STEP DRILL IS THE ANSWER !

Production swings up when step drills are used because . . .

- **One tool does more than one operation.**
- **Greater accuracy is maintained — concentricity being automatic.**

Production costs swing down because step drills made to your specifications are only slightly more in cost than a simple twist drill.

Made to your own specifications PROMPT SERVICE

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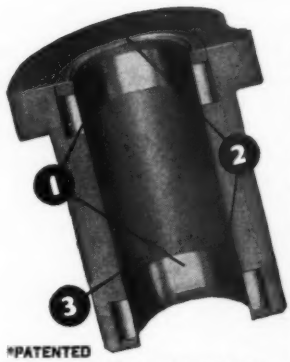
COMET® TOOL CO.

738-T BROADWAY • NEW YORK 3, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 1822

INCREASE PRODUCTION.. SAVE TIME & MONEY



*PATENTED

1. Tungsten carbide rings at the points of wear; 2. Steel rings protect drills and carbide; 3. Special hardened alloy steel body.

For information and prices write for MEYCO Bushing Catalog No. 41

MEYCO

Carbide Inserted Bushings Are Doing It Daily!

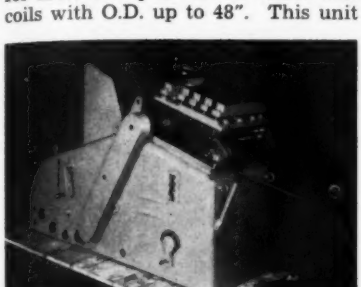
How? Like this: (1) Last longer . . . with a life—in most cases—as long as solid carbide bushings at prices that approach the price of steel bushings; (2) Increased life for your drill jigs and fixtures; (3) Increased life for your drills and reamers; (4) Accuracy maintained for a LONG PERIOD of time; (5) Less non-productive machine time, less lost man-hours, because bushings need not be changed as often; (6) Inspection time saved, because of greater accuracy for a longer time; and (7) Less waste due to spoilage, for the same reason. Don't pass up a good bet! Get the dope on MEYCO Carbide Inserted Drill Jig Bushings today!

ESTABLISHED 1888

W. F. MEYERS CO., INC., BEDFORD, INDIANA

CIRCLE INFORM-A-GRAM KEY NO. 1823

The PDSC-1648 U. S. Power Driven Straightener and Coil Cradle is an addition of the line of automatic press room equipment. It is suitable for material up to 16" in width and coils with O.D. up to 48". This unit



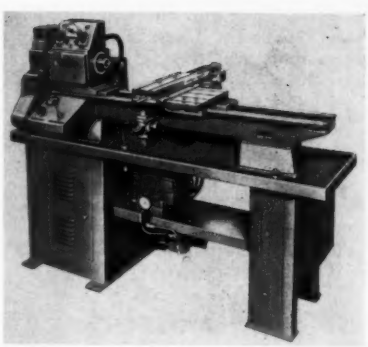
is equipped with loop control mechanism and 3-hp vari-speed motor for output speeds from 26 to 76 fpm. The cradle is equipped with four power driven rest rolls, one idler rest roll, and one bumper roll. U. S. Tool Co., Inc., Ampere, N. J.
Circle Inform-A-Gram No. A29.

A Line of Standard High Speed Roll Feeds indexed with a roller gear drive provides great repetitive accuracy at rates up to 1,000 spm. The cam indexing method features positive feeding action without frictional

braking to eliminate inconsistent feeding. This machine maintains an accuracy of 0.002" or greater. Standard units are available with strokes between 1" or less to 10" and rolls up to 12" wide. Ferguson Machine Corp. of Indiana, P. O. Box 5841, St. Louis 21.
Circle Inform-A-Gram No. A30.

Save Up to 50% in Setup Time and almost eliminate die damage due to ram overtravel with the incher-control. It can be used for power presses, power brakes, shears, and other similar machinery. Almost micrometer exact control of ram movements during all phases of setup or tool and checking operations is achieved. This positive incher is an electro-magnetic control which connects directly to controlled machine's motor circuit and operates from the same voltage contractor. Carp Controls Co., 30 Meadow St., S. Norwalk, Conn., or —
Circle Inform-A-Gram No. A31.

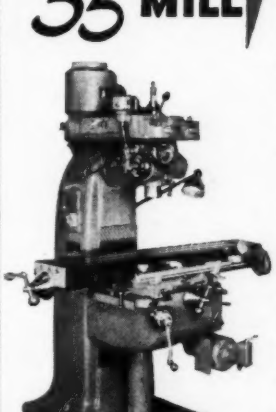
Cut Costs in Short and Long Production Runs with the Clausing Hydra-Cycle semi-automatic turning and boring machine. It assures maximum economies by performing several machining operations simultaneously or in continuous sequence. No. 6405 has a hydraulically operated cross slide mounted on a hydraulically operated longitudinal table. Clausing Div'n, Atlas Press Co., 21115 N. Pitcher St., Kalamazoo, Mich.
Circle Inform-A-Gram No. A32.



Produce MORE...
Produce it BETTER!
ON THESE IMPROVED ECONOMICAL
INDEX VERTICAL MILLS

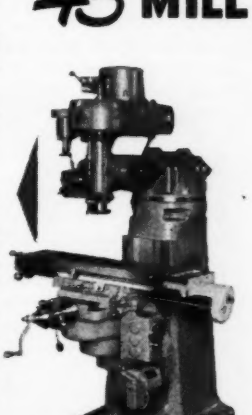
Super "55" MILL

1½ HP Head or optional 2 HP with continuous duty motor gives 50% or more capacity . . . More rigidity, more accuracy . . . Increased horse power and dynamically balanced Cast Iron Pulleys and Drive System afford improved production capacity . . . More weight in the column, heavier ribbed column, heavier knee, heavier saddle.



"45" MILL

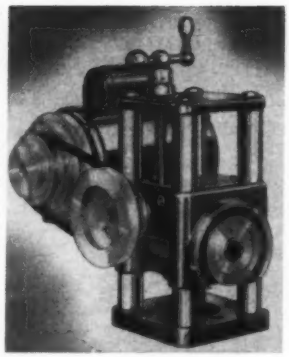
Unique square design of overarm affords more rigidity, greater accuracy . . . Provides extra range and capacity . . . More power at the cutter. No adjustment required on overarm and head after use . . . No need to re-indicate head after moving overarm . . . Speed range with nine changes makes possible the use of high speed or carbide tipped cutters to best advantage.



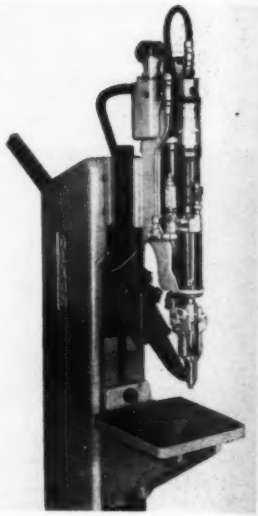
INDEX MACHINE CO.
541 N. MECHANIC STREET JACKSON, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 183

Save Time and Manpower and Maintain Close Tolerances while removing metal at higher production rates with the portable Versa-Mil. It performs at any angle in any required position or direction, as an independent unit with its own feeds, or added to lathes, planers, millers, shapers, grinders, etc. The Dumore Co., 1300 17th St., Racine, Wis.
Circle No. A33.



Drive Screws and Nuts up to 7/16" thread size at speeds up to 60 spm with an automatic screw driver. The Auto-Driver, Model SD-1, operates at 2,000 rpm and has a 3" stroke. Other speeds and strokes are available to suit special requirements. The automatic stopping control signal stops if screw is not placed correctly. Dixon Automatic Tool, Inc., 2300 - 23rd Ave., Rockford, Ill.
Circle No. A34.



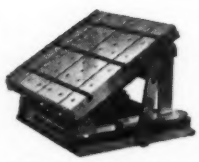
INVEST JUST 12 PENNIES A DAY

TO SAVE DOLLARS THE *Robbins* WAY

Robbins angular tooling equipment often pays for itself the first few times you use it . . . but let's be conservative. Let's talk about writing off the cost over ten years. (About half the useful life of a "Magna-Sine!") Written off in this manner, the Model A-5 Magna-Sine illustrated represents an investment of around twelve cents a day!

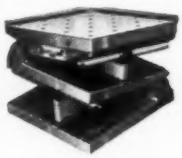
This equipment saves dollars of valuable toolroom time on every job. Set-ups that require *hours* by other methods take just *minutes* the Robbins way. Set up to machine, grind or inspect any angle in just four simple steps: (1) Look up required angle in Table of Constants furnished with unit, (2) Select gage blocks indicated, (3) Place blocks between base and sine bar swivel block, (4) Secure the work . . . and you're ready to go!

This simple, fast, sure method sets up any angle, single or compound, right or left hand, without V-blocks, angle plates or complicated "build-ups." Complete range of models and sizes puts Robbins precision equipment within the reach of every shop. Write now for literature.



HEAVY DUTY SINE PLATE FOR MACHINING

"MAGNA-SINE" WITH MAGNETIC TABLE



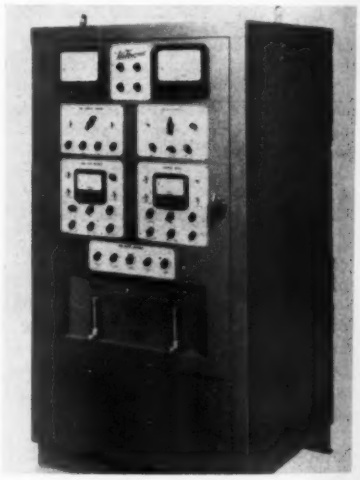
FOR INSPECTION AND LIGHT MACHINING

OMER E. *Robbins* COMPANY
24800 PLYMOUTH ROAD DEPT. C DETROIT 39, MICH.
Also manufacturers of special machinery, automatic assembly machinery. 5937

CIRCLE INFORM-A-GRAM KEY NO. 184

Use the Lead-Screw Revolution Counter with all types of milling machines and other machine tools where a cumulative count of lead-screw turns is desired. Because this instrument records precisely the exact number of desired lead-screw turns, the work travels faster since there is no hesitation while making a mental count. The counter is made in various thread sizes to fit any special lead-screw handle bolts. Pacific Transducer Corp., 11836 W. Pico Blvd., Los Angeles 64, or —
Circle Inform-A-Gram No. A35.

Obtain Automation in Arc Welding with Weltronic tungsten inert gas fusion welder control. It can be used when welding titanium, high temperature stainless steels, and other hard to weld alloys. Every unit in this control is designed and

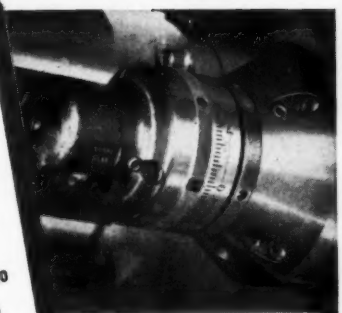


built to accurate resistance welder specifications. Electronic timers are used for sequencing. The arc cut current and the arc voltage are controlled within 2%. Weltronic Co., 19500 W. Eight Mile Rd., Detroit 19, or—**Circle Inform-A-Gram No. A36.**

DEKA® BORE

cuts setup time 300% at FORD PLANT!

THE PLACE: FORD MOTOR CO., AIRCRAFT ENGINE DIVISION, CHICAGO
THE JOB: BORING HIGH ALLOY STEEL LINERS IN MAGNESIUM HOUSING (36 Rockwell "C")
REPORT BY: TOOL ENGINEERING DEPT.



"Bore diameter tolerance is plus or minus .0003". There's an edge wear of .0001" to .0002" on the tool bit in the initial pass. Before, each final pass took several time consuming adjustments. We changed to a Deka-Bore boring head, and cut setup time 300%, because the Deka-Dial permits positive .0001" adjustment on all settings, in a few seconds. No backlash, either."

DEKA® BORE

OFFSET BORING HEADS
BORING BARS
REPEAT TO .0001"
IN 30 SECONDS!
100% GUARANTEED!

Attach this ad to your letterhead for free demonstration or literature!

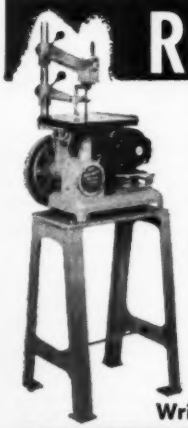
PRECISION TOOL & MFG. CO. OF ILL.

1305 South Laramie, Cicero 50, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 1851

Smoother Production! Higher Output! Lower Costs!

RICE-MILWAUKEE



DIE FILERS . . . for straight-line sharp corner filing, sawing and lapping.

This low cost precision-built unit performs all die making operations at savings up to 40%. Furnished complete with motor and two overarms. No extras to buy.

PROFILE GRINDERS

. . . for high speed Precision Grinding of Curved and Irregular Contours.

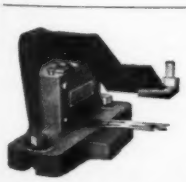
Standard features include 20,000 or 30,000 R.P.M., or a combination of these spindle speeds, ½ H.P. motor, Collet Chuck, Compound tilting table, built-in wheel dresser.

Write for Illustrated Bulletins and Prices

RICE PUMP & MACHINE COMPANY

228 PARK AVENUE BELGIUM WISCONSIN

CIRCLE INFORM-A-GRAM KEY NO. 1852



New Low Cost
AUTOMATIC SCRAP CHOPPER

3" wide **$69.00**
6" wide $95.00
12" wide $195.00

Write for details

JACO DEVICES, INC.
96 High St., Hingham, Mass.

CIRCLE INFORM-A-GRAM KEY NO. 1853

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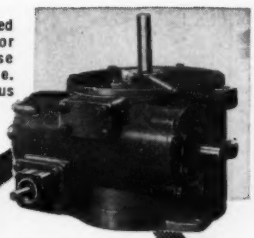
monroe
THE MOST PROGRESSIVE FIXTURE CLAMP LINE

Catalog available from
monroe
Engineering Products
1515 Hurd Road
Monroe, Michigan

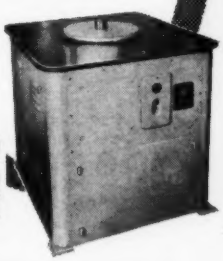
CIRCLE INFORM-A-GRAM KEY NO. 1854

Basic cam-operated indexing unit for special purpose machine drive. Available in various sizes.

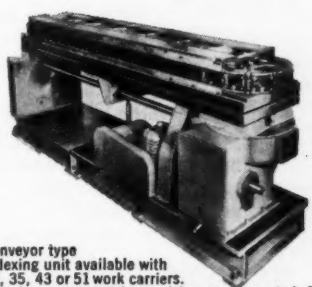


The basic units for AUTOMATIC assembly or production

...Standard Tool precision, proved cam-operated indexing units.



Basic cam-operated indexing unit incorporated in standard table with mechanical locking arrangement, timer and drive.



Conveyor type indexing unit available with 27, 35, 43 or 51 work carriers. Indexing movement is precision cam-operated. Side and top machine surfaces allow for ease of tool mounting. Furnished complete with drive.

1. *Reduces design time.*
2. *Permits rapid re-tooling when necessary.*
3. *Wide range of sizes and indexing increments.*

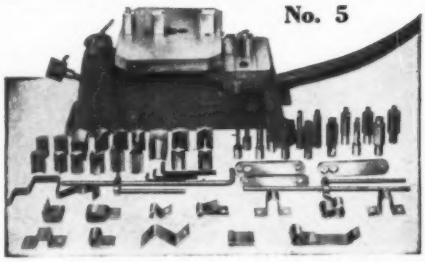
Standard Tool indexing units provide smooth, accurate positioning between automatic production stations. They are built for heavy duty operation and furnish the basic requirement for profitable automation. Engineers at Standard Tool are skilled in manufacture of completely automatic assembly and production machinery into which these indexing units are incorporated. Your inquiries will receive prompt, competent acknowledgement.

STANDARD TOOL & MANUFACTURING CO.

Creative Machine Designers and Builders Since 1910 » » « «

KEARNY, NEW JERSEY

CIRCLE INFORM-A-GRAM KEY NO. 1855



No. 5

Multiform

BENDER-CUTTER

CUTS, BENDS, PUNCHES

Available in hand or air operated models, the MULTIFORM is shipped complete with full assortment of dies and mandrels to form and cut round or flat stock up to ⅛"x1½" as illustrated. Punching and round end blanking dies available. Other models up to ¼"x4" air operated.

WRITE FOR DESCRIPTIVE CIRCULAR

ALSO AIR OPERATED MODELS

J. A. RICHARDS CO. KALAMAZOO, MICH.

CIRCLE INFORM-A-GRAM KEY NO. 1861

HARDENED and GROUND HSS BLANKS

Any decimal diameter — any length. Mirror finish surface to gage tolerance.

Many uses — —core pins, punches, gages, ejector pins, insert pins, special tools, etc. — Quick delivery.

Write or phone DRexell 6-4223 for price list D-3

WILLIAM T. HUTCHINSON CO.
53 Brown Ave., Springfield N. J.

CIRCLE INFORM-A-GRAM KEY NO. 1862

most VERSATILE PIN GAGES *made!*

Horberg exclusive taper feature lets you check undersize, oversize and odd-size holes, slots, etc., quickly and accurately with standard letter, number or drill-size gages.

A precision concentric taper on the lower half of each gage runs to 0.0012" smaller than gage size. You get a continuously accurate range of measurement with each gage, for quicker, handier, precision gaging in set-up, machining, tooling and inspection operations.

SPECIFICATIONS

Diameter accurate to +0.0001" —0.0000"
Standard 1.5" length
Concentric taper on lower half to .0012" smaller size
Oil hardened tool steel

PRICES AND ORDER FORM (F.O.B. Bridgeport, Conn.)

_____Letter sets—52 gages A-Z in pairs $65.00
_____Fraction sets—60 gages 3/64" to 1/2" in pairs $75.00
_____Number sets—120 gages 1-60 in pairs $130.00
_____Single gages_____size ea. $1.50

Sets furnished in indexed plastic case. Extra case $15.00
Prices subject to change without notice.

Please rush items checked to:

Name_____

Company_____

Address_____

Horberg GAGE COMPANY 29 Staples St., Bridgeport, Conn.

CIRCLE INFORM-A-GRAM KEY NO. 1863

CONTRACT TOOLING AND PRODUCTION

Illinois

DRESEL-BETZ CO.
Belleville, Ill.
Designers and Manufacturers of Tools, Dies, Jigs, Fixtures, Metal Stampings,

Michigan

DAVIS TOOL and ENGINEERING CO.
19250 Plymouth Road, Detroit, Michigan, VErmont 5-6000. Tools and Dies, Special Machinery, Sheet Metal Stampings and Assemblies.

UNIVERSAL GEAR & MACHINE CO.
1301 E. McNichols Road
Detroit, Michigan, Forest 6-2280
Gears, Sprockets, Worms, up to 168". Free Catalog of 8,000 Stock Items. Free 36-page Catalog on our manufactured machinery of complete slitting, uncoiling, recoiling and cut to length lines.

Ohio

CLEVELAND UNIVERSAL JIG COMPANY
13404 St. Clair Ave., Cleveland, Ohio. MU 1-2600
DESIGNERS AND BUILDERS
Jigs and Fixtures Special Machines
Production Engineering
Complete Plant Routing and Tooling

GENERAL DIE & TOOL CO.
2067 W. 55th St., Cleveland, Ohio
WO 1-4736
Dies, Tools, Jigs, Fixtures, Light Stampings, Special Machinery Manufacturing.

THE INDUSTRIAL MACHINE CO.
1436 East 47th St., Cleveland, Ohio. Founded in 1908. Builders of Special Machinery. General Machine Work.

KIFFER TOOL & DIE CO.
5601 Tillman Avenue, Cleveland, Ohio. WOodbine 1-2440 & 1-2441. Manufacturers of Special Machinery, Tools, Dies, Jigs, Fixtures, Swiss Jig Boring.

NOBLE & STANTON, INC.
998 Broadway, Bedford, Ohio, Bedford 2-2800. Tooling, Short Run Production and Machined Parts for Automation.

Pennsylvania

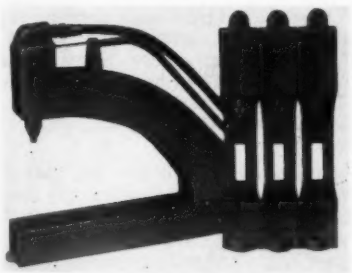
MEDAL MANUFACTURING CO.
328 Vine St., Sharon, Pa. Machined parts, complete machine assemblies, special machinery. Send us your prints for quotes.

For Tough Milling Jobs use the P.D.Q. Manchester Face Mill Cutter. This face mill can take a 2½" dia cut, and the shear cutting action of the double inserts offer a fast and well finished surface. The carbide inserts

can be changed in seconds and easily re-set with a tool setting gage furnished with each cutter. The tool is available with ¾" or 1" dia shanks. Portage Double Quick, Inc., 1046 Sweitzer Ave., Akron 11, Ohio.
Circle Inform-A-Gram No. A37.

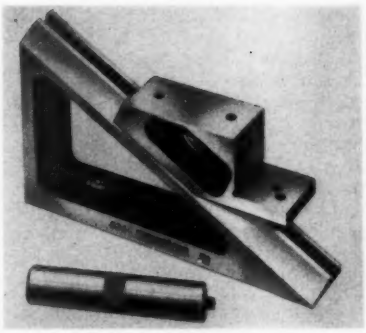
A Tool Tray Designed Especially for their 14" precision model drill presses has been developed by South Bend Lathe Works, South Bend 22, Ind. Made of aluminum, the tray clamps around the 2¾" drill press column. It is easily adjustable to any height or position. It provides a place for small tools, extra drills, and other accessories and eliminates the tendency to lay tools on the drill press table.
Circle Inform-A-Gram No. A38.

Airchamp is an Air-Operated Impact Hammer with slimline design for miltiple installation. It is versatile and stakes swages, stamps, cuts, marks, and punches. This hammer can be set up for multi-stage operation on 2¼" centers, and as



many as 10 airchamps can be operated off a ½-hp air compressor, consuming 1½ cu ft of air per min, each delivering 50 strokes per min. It has a 2" stroke; has a clearance in ram height from base of 5" and offers a 10" throat. High Speed Hammer Co., 313 Norton St., Rochester, N. Y., or — **Circle No. A39.**

Eliminate Side Play and Provide Accurate Alignment and Parallelism between working surfaces with the planer and shaper gage. With an extension usable on three surfaces, No. 624 has a range from ¼" to 10". It incorporates a precision level, and the platform has an extra tapping hole to accommodate a post for indicators and other accessories. The base and slide are steel forgings and, they and the extensions, are hardened and ground. Brown & Sharpe Mfg. Co., Providence, R. I., or — **Circle Inform-A-Gram No. A40.**



Write for literature covering all the features of the new comparator gauge.

NEW PDQ
inteRapid
GROOVE CHECKING
Comparator Gauge
offers...

★ Precision, range and versatility
★ 3 and 2 point checking—3 point for production, 2 point for short runs
★ Quick setting adjustment knob sets scale reading from gage blocks, mikes or ring gauge.
★ Locking lever locks arms after setting is made
★ Retracting lever allows in and out movement of measuring arms while positioning instrument
★ Easily read large meter-type face is graduated in .0005".
★ Interchangeable tips offer versatility in application

The new P.D.Q. groove checking comparator gauge offers guaranteed Swiss accuracy and workmanship.

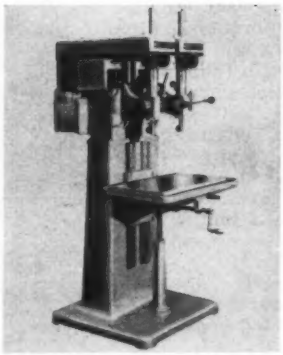
Sets come complete with both short and long groove tips, special "flat bottom" tips, button tips, centering arms, spare screws, special socket wrench and screw driver, all in one compact, sturdy case. Units measure internal grooves from 3/8" to 6"

Representatives in principal cities

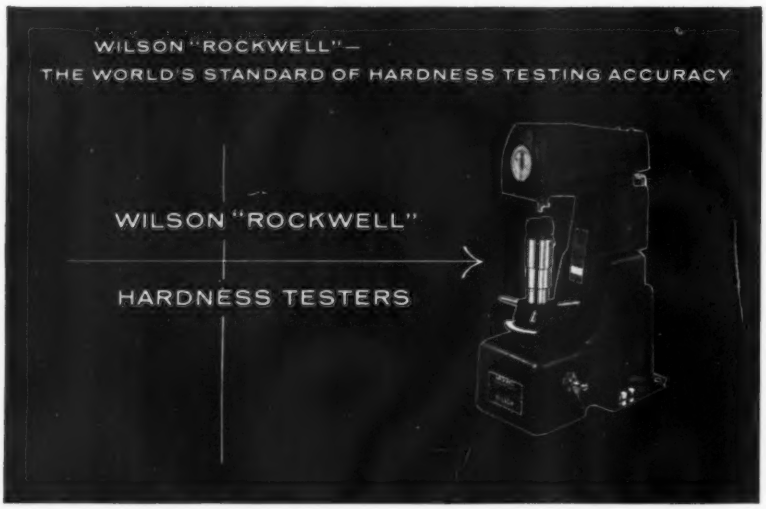
PDQ
PORTAGE Double-Quick, Inc.
1046 SWEITZER AVENUE • AKRON 11, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 187

Reduce Costs and Obtain Greater Adaptability with the high speed sensitive drilling machine. The model 1F has a 10" overhand and machines from one to six spindles, with speed ranges from 625 to 10,000 rpm. It does not have to be stopped to change belts or gears, and can be adapted to meet all requirements. Edlund Machinery Co., Cortland, N. Y. **Circle No. A41.**



Designed Specifically for Driving Studs in die castings is the pedestal Studrive unit. These units are high speed, flexibile, precision, tools (cycle time 1.5 sec) with lead screw feed. Triangular construction allows for grouping in unlimited positions. Operated by air cylinder, they require only 0.3 cu ft/stroke air consumption. Studrive, Inc., 2704 E. Larned, Detroit 7, or — **Circle No. A42.**



A FULL WILSON LINE TO MEET EVERY HARDNESS TESTING REQUIREMENT

FULLY AUTOMATIC • SEMI-AUTOMATIC • REGULAR • SPECIAL • SUPERFICIAL • MICRO & MACRO HARDNESS TESTERS

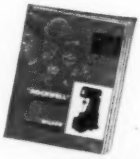
When it's WILSON "ROCKWELL"-TESTED *you KNOW it's RIGHT!*

Easy to operate—all controls at hand

Takes rough service—maintains accuracy after years of operation

Expert Wilson service—helps you choose proper model—keeps it at work.

A staff of WILSON hardness testing experts is available to help choose the model best suited to your job—and provide quick emergency service if it is ever needed.



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MECHANICAL INSTRUMENT DIVISION
AMERICAN CHAIN & CABLE

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ACCO TRADE MARK

CIRCLE INFORM-A-GRAM KEY NO. 188

Reduce Hardfacing Costs using the tubular wire electrodes for open arc semi-automatic welding with the Amsco MF welder. Weld metal is deposited up to 200% faster with these electrodes than with the fastest manual rods. The deposits are also

more uniform and the quality of the weld is improved. This method of building up worn surfaces and hardfacing for impact and abrasion resistance can afford big savings. American Manganese Steel Div'n, American Brake Shoe Co., 230 Park Ave., New York 17, or — **Circle Inform-A-Gram No. A43.**

Combine Go and Not Go Ends of Wire Type Plug Gages for any double and combination in a matter of seconds with VK duplex handle.

This handle makes possible the maximum control and flexibility of stocked gages as requirements change. The Van Keuren Co., 176 Waltham St., Watertown, Mass., or— **Circle Inform-A-Gram No. A44.**

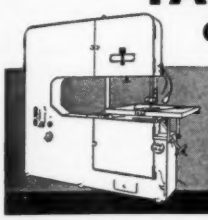
FRICTION SAWING with Tannewitz HIGH SPEED BAND SAWS

FASTEST, BEST MEANS OF CUTTING METALS

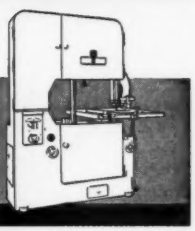
If you are not familiar with the advantages of friction sawing with these machines, by all means drop us a line asking for "Friction Sawing Data." You can save many times the cost of a Tannewitz High Speed Band Saw and greatly expedite production by using it to cut sheets of both hard and soft steel, formed or flat, trimming malleable and steel castings, cutting armor plate or many other materials. Write NOW!

THE **TANNEWITZ WORKS**

GRAND RAPIDS, MICHIGAN ☎ GL-6-1729



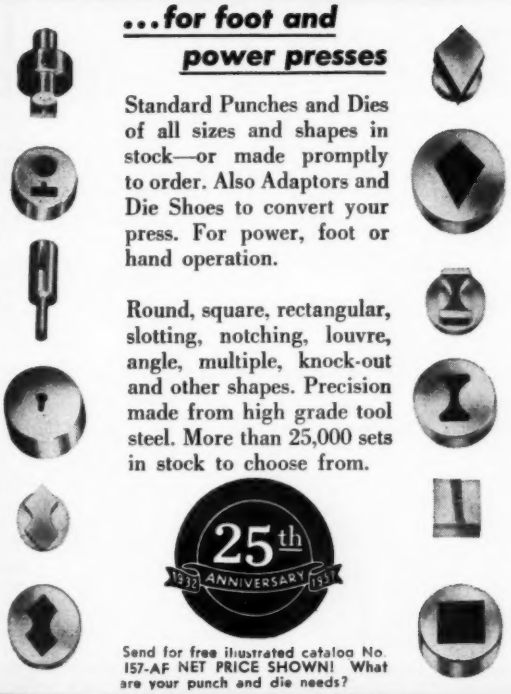
TANNEWITZ DI-SAWS — 24", 36", 48", 60" CAPACITIES
for CONTOUR SAWING, FILING, POLISHING
The smoothest, fastest, most trouble-free Di-Saws on the market. Write for bulletin.



CIRCLE INFORM-A-GRAM KEY NO. 1891

Punches and Dies

...for foot and power presses



Standard Punches and Dies of all sizes and shapes in stock—or made promptly to order. Also Adaptors and Die Shoes to convert your press. For power, foot or hand operation.

Round, square, rectangular, slotting, notching, louvre, angle, multiple, knock-out and other shapes. Precision made from high grade tool steel. More than 25,000 sets in stock to choose from.

25th ANNIVERSARY 1932 1957

Send for free illustrated catalog No. 157-AF NET PRICE SHOWN! What are your punch and die needs?

WARD Machinery Co. 564 West Washington Chicago 6

CIRCLE INFORM-A-GRAM KEY NO. 1892

You can't go wrong

in buying Granite Surface Plates

if you follow these rules . . .

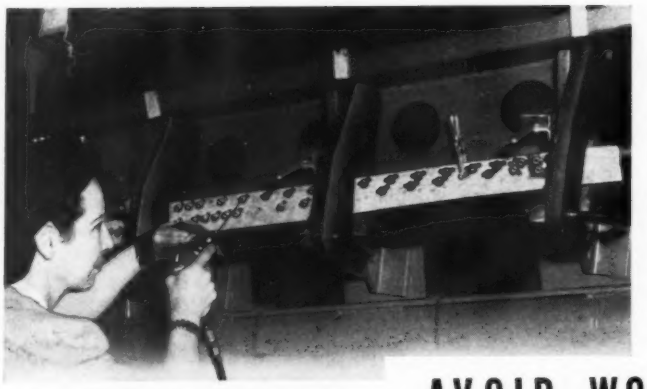
1. Be sure that surface plates are TRUE QUARTZ GRANITE, which is unequalled for surface plate performance. (In some cases, black diabase is being classified as "granite").
2. Look for *clearly defined accuracy.* Get a full explanation as to maker's method of expressing flatness.
3. Investigate for *wear resistance* properties.
4. Don't be misled by claims pertaining to such irrelevant factors as "high compressive strength". (The truth is that all granites possess far more compressive strength than is ever needed for surface plate use).
5. As in everything else, be guided by the reputation of the manufacturer.

We invite you to apply this check-list against Bryant Rock-of-Ages "TRUE" Granite Surface Plates. You'll find that these surface plates are the finest in every respect. This is because Bryant Rock-of-Ages Surface Plates, made of premium granite from the world's largest quarries, are finished *on the head of the grain;* and because their accuracy and satisfactory performance are guaranteed by two of the leading names in American industry. Write today for free folder.

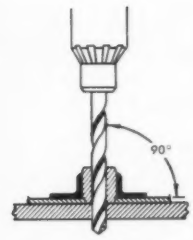
BRYANT GAGE & SPINDLE DIVISION
Box 620H Springfield, Vermont

DIVISION OF BRYANT CHUCKING GRINDER CO.
Internal & External Thread Gages • Granite Surface Plates • Magnetic Drums for Computers

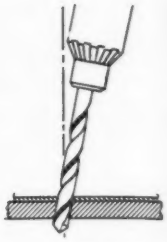
CIRCLE INFORM-A-GRAM KEY NO. 1893



Free hand drilling of perpendicular holes using Anchor Bushing Drill Template at Ryan Aeronautical Co., San Diego.



ANCHOR BUSHING DRILL TEMPLATE — DRILL SUPPORTED AT LOW COST.



UNBUSHED DRILL TEMPLATE FOR LOW VOLUME PRODUCTION — NO DRILL SUPPORT.

AVOID WORK SPOILAGE—USE ANCHOR BUSHING DRILL TEMPLATES

NUTPLATE ANCHOR BUSHING

STANDARD ANCHOR BUSHING

Rejects threaten when unbushed drill templates are used to replace expensive drill jigs or fixtures on small quantity production runs.

Being low in cost and easy to make, Anchor Bushing drill templates prevent off-perpendicular drilling, inaccuracies of hole location and the use of wrong drill sizes.

Anchor Bushings are riveted or spot-welded to sheet metal, and riveted on or imbedded in laminated plastic materials. These lightweight drill templates can be made flat or in compound curves for a fraction of the cost, time and skill required for drill jigs or fixtures.

Learn how to make low cost, accurate drill tooling — write for the Anchor Bushing Catalog.

hi-shear RIVET TOOL COMPANY

2600 WEST 247TH STREET • TORRANCE • CALIFORNIA

Sales Representative for Kirk-Wing Company, Vega Baja, Puerto Rico.

CIRCLE INFORM-A-GRAM KEY NO. 1901

MAYLINE

Mayline Has The Outstanding Buy in Steel Base 4-Post Tables!

Notice in particular the following features of Mayline tables. *Base is of heavy gauge steel. *Wood feet have inset no-mar levelers. *All metal drawers run on ball bearing rollers. *Top is solid basswood with steel edges. *Available in 5 top sizes and 5 combinations.

For complete information and prices, write the Mayline Company.

MAYLINE COMPANY, INC.

635 No. Commerce St.

Sheboygan, Wisconsin

MAYLINE

MAYLINE

MAYLINE

CIRCLE INFORM-A-GRAM KEY NO. 1902

SPEED UP PRODUCTION

with these PALMGREN

ANGLE VISES · MACHINE VISES

ROTARY TABLES

See how Palmgren vises, rotary tables, milling attachments and other machine tool accessories can speed up YOUR production and save time and money, too. Used in all industries, EVERYWHERE. 64 different models and types. Send for new catalog No. 203.

$39.95

No. 24B ANGLE VISE

4" jaw

Solve difficult Angle jobs on the production line—quick, accurate setups at any angle in such operations as drilling, milling, grinding. Also other jaw sizes: 1½", 2½", 3", 4", 6" and 8".

No. 60B MACHINE VISE

6" jaw

$99.95

A precision vise, with or without swivel base, constructed for heavy-duty service in such jobs as milling, drilling, grinding, shaping and other operations requiring a rugged holding device. Also 40B—4" jaw.

$79.95

No. 83 ROTARY TABLE

Two cross feed slides and Rotary Feed converts your drill press for vertical milling. The No. 83 has an 8" diameter top with T slots ⅝" x 1" x ⅝" for keys or T bolts. Rotary dial is graduated in 3 minute intervals.

CHICAGO TOOL AND ENGINEERING CO.

8388 South Chicago Ave. • Chicago 17, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 1903

The Spray-Cooler, an Easily Portable Cooling System for metalworking machines, has been introduced by the Triple E Engineering Co., Racine, Wis. It is especially suited to machines which are not in regular

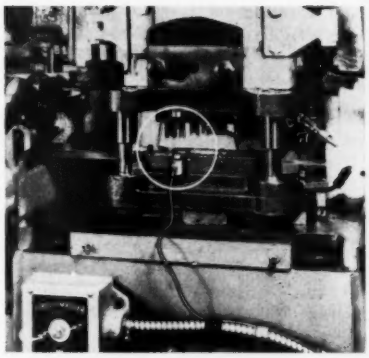
use, because of the cooling unit's portability and simplicity of installation. Employing the spray cooling principle, whereby finely atomized particles of coolant are directed at the point of cutting, the unit has been successful in prolonging tool life from 50% to 500%.
Circle Inform-A-Gram No. A45.

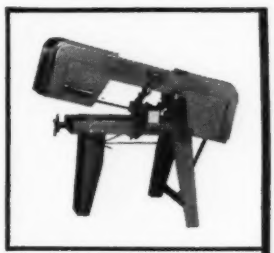
An Improved Tool Holder and an Increase in the Number of Tool Holder Styles for use with cemented carbide indexable inserts is available. The tool holder has a clamp which has a positive gripping action and gives greater chip clearance. The clamp can be used with or without the chip breaker. The clamp screw is accessible from both top and bottom of the holder, an advantage when using a rear tool carriage. Carmet Div'n Allegheny Ludlum Steel Corp., 20th Floor, Henry W. Oliver Bldg., Pittsburgh 22, or —
Circle Inform-A-Gram No. A46.

A Long Life of 25,000,000 Cycles is a feature of a new Silver Model valve which has been added to the Skyline series. It is one of six that

can be mounted interchangeably on seven valve bodies. Information on these products can be obtained from Ross Operating Valve Co., 120 E. Golden Gate Ave., Detroit 3.
Circle Inform-A-Gram No. A47.

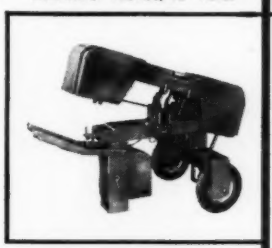
Prevent Tool and Die Damage caused by mechanical overload with an electronic-mechanical press control. On first contact with an overload the sensing unit sends an impulse to the electronic control unit which is relayed to the clutch solenoid, stopping the press immediately. The Circuit Master automatically adjusts itself to normal temperature changes, voltage fluctuations, and other mechanical changes. Wintriss, Inc., 20 Vandam St., New York 13.
Circle Inform-A-Gram No. A48.



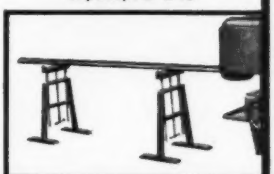


Model B (Wet or Dry) Dependable. Economical. Easily handles 5" rounds, 10" flats.

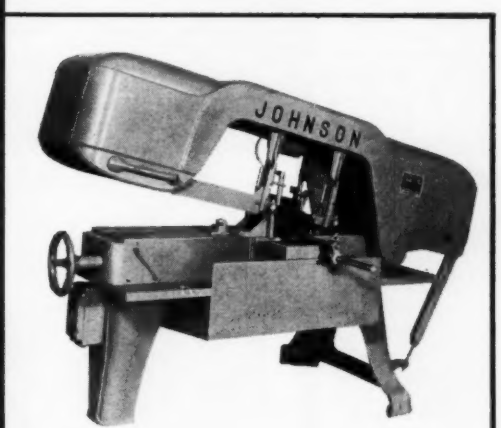
Johnson
Speaks for itself in ANY SHOP!



Model M (Mobile). Rolls to the job, inside or out. Capacity: 5" x 10"



Johnson Adjustable Stock Stand. Provides rigid, safe work support.



The Big Model J. (Wet or Dry) Fast. Tough. Accurate. Capacity: 10" rounds, 18" flats

The big, dependable Johnson delivers more saw for less money. It easily and accurately handles anything in your stock pile: rods, angles, tubes, heavy rounds, irregular shapes, and flats.

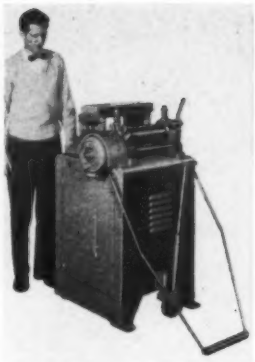
Whatever model fits your production requirements, you'll find Johnson versatility will boost your production and lower your metal cutting costs. Today, the Johnson saw speaks for itself in thousands of progressive shops . . . *why not yours?*

Johnson MANUFACTURING CORPORATION
1017 BARNES STREET, ALBION, MICHIGAN

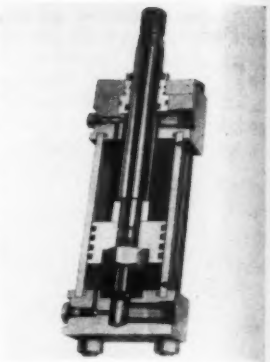
Eastern Distributor	*Mid-Western Distributor*	*Western Distributor*
R. J. R. KELLY CO.	W. Q. LUNDMARK	HASTINGS DISTRIBUTORS
Hale Bldg., 51 Main St. East Orange, N. J.	75 N. Broadway Des Plaines, Ill.	1605 Solano Avenue Berkeley, Calif.

CIRCLE INFORM-A-GRAM KEY NO. 191

Improved Littell "308" Series Straightening Machines are now equipped with a Warner electric clutch-brake assembly. These straighteners supply straightened coil stock 0.018" to 0.065" thick, 1" to 8" wide at speeds of 20 to 120 fpm. They also serve as automatic feeding units. Automation Div'n, F. J. Littell Machine Co., 4127 N. Ravenswood Ave., Chicago 13.
Circle No. A49.

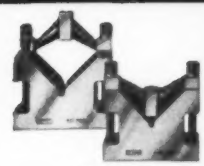


Rated for Heavy-Duty Service at 2000 psi and higher is the line of series N hydraulic cylinders. Standard cylinders in the line are available in bores ranging from 1½" to 12". A choice of 13 standard mountings to meet varied installation requirements and large or small external threads, or internal threads are provided. Hydro-Line Mfg. Co., 5600 Pike Rd., Rockford, Ill.
Circle No. A50.

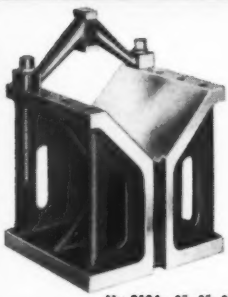


TOP PRECISION IS AN EASY SETUP ...with Taft-Peirce V-Blocks

No. 9133-4 CAST IRON V-BLOCKS
Accurately ground to size in pairs. Made from finest quality seasoned grey iron castings. All surfaces except top are square or parallel with each other within .0005".



No. 9128-30 STEEL V-BLOCKS
Sold in pairs only. Made of alloy steel, hardened and ground. "V" is central with sides, parallel with bottom, square with ends within .0003". All surfaces square or parallel within .0002".



No. 9134—8" x 8" x 8" V-Block

No. 9131 UNIVERSAL V-BLOCK
Hole in center permits quick, accurate setups. Also provides clearance for tool in drilling and boring. Made of alloy steel, hardened and ground on all working surfaces. All sides square within .0001". Sold singly or in pairs.

Use these standard V-Blocks from tool chest to tool crib, for new speed and accuracy in machining and inspection.

The Taft-Peirce V-Block design combines the tolerances you need with the multiple use you want. No. 9130, for example, can be laid directly on its side with clamps in place. No. 9131 Universal style has a ground and lapped hole in the base for easy locating and to simplify holding parts which must be bored or drilled through completely.

Make sure you have ample quantities of every Taft-Peirce style on hand. They can save important time and cut costs all through your machining and inspection operations. For complete listing of models and prices, contact your nearest representative, or write: Taft-Peirce Manufacturing Co., Woonsocket, R. I.

For *everything* in the tool room . . .

TAKE IT TO TAFT-PEIRCE

THE TAFT-PEIRCE MANUFACTURING CO.
WOONSOCKET, R. I.

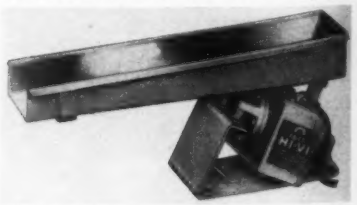
T-P Means TOP Precision

CIRCLE INFORM-A-GRAM KEY NO. 192

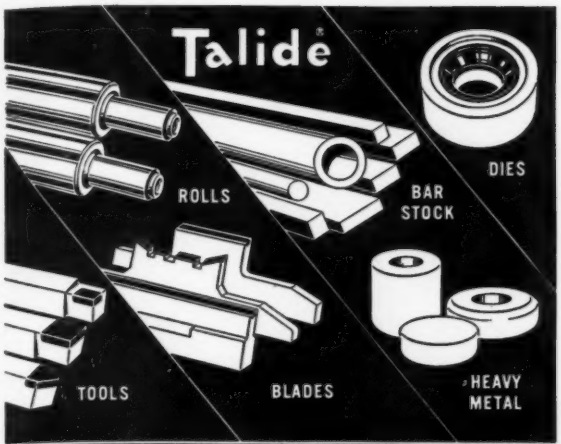
The Model 803 Clamp Comes Equipped with a solid steel toggle bar pressure foot and L shaped solid steel base which facilitates clamp installation on flat surfaces or slotted machine tables. Clamping force

varies from light to force in excess of 700 lbs. Ample hand clearance is provided between toggle bar and the handle when the clamp is opened to its full limit. Robert J. Kelly Mfg. Co., P.O. Box 4938 Redford Station, Detroit 19, or —
Circle Inform-A-Gram No. A51.

Greater Output Is Provided by the Hi-Vi Electro-Permanent Magnetic Vibratory Feeders. They give higher operating efficiency over broader operating ranges and materials may be moved at a faster rate of speed.



The units have an electro-permanent magnetic drive system which requires no rectifier. The feeder operates at 3600 cpm directly off an AC line. Eriez Mfg. Co., Erie 6, Pa., or—**Circle Inform-A-Gram No. A52.**



HARDEST MAN-MADE METAL!

● New, improved TALIDE METAL is uniform in quality—gives top performance on ALL cutting, drawing and wear-resistant applications. Write for Catalog 56-G. METAL CARBIDES CORP., Youngstown 12, Ohio.

METAL CARBIDES CORPORATION
TALIDE
YOUNGSTOWN 12, OHIO

HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • ALUMINUM OXIDE • HI-TEMP. ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

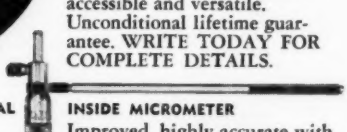
CIRCLE INFORM-A-GRAM KEY NO. 1931

NO REVERSE LEVER!
WON'T STICK!
.075 TRAVEL!
RUGGED!

PEARSON DIAL INDICATOR

wears IN, instead of wearing out!

A highly sensitive, easy-to-read finger-type indicator that will read either direction *without reverse lever* or clumsy gear shifting. Will accurately *repeat within .0001*. The *extra long contact point* makes it more accessible and versatile. Unconditional lifetime guarantee. WRITE TODAY FOR COMPLETE DETAILS.



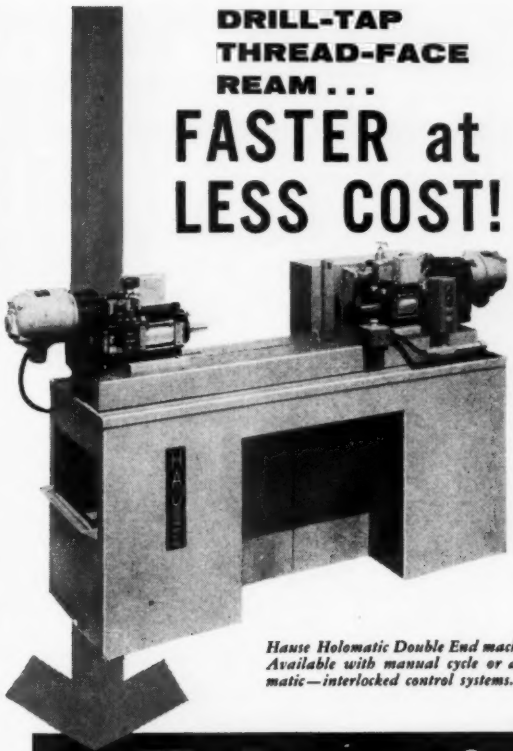
INTERNATIONAL INSIDE MICROMETER

Improved, highly accurate with new 1½" feature permitting use in small diameters.

WRITE TODAY! M&G INSTRUMENT CO.
Dept. 10, 12940 Saticoy Street, North Hollywood, California
DEALER INQUIRIES INVITED

CIRCLE INFORM-A-GRAM KEY NO. 1932

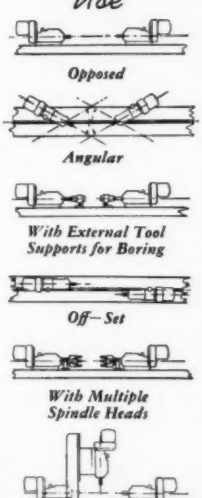
DRILL-TAP
THREAD-FACE
REAM . . .
FASTER at
LESS COST!



Hause Holomatic Double End machine. Available with manual cycle or automatic—interlocked control systems.

with a Holomatic

Methods of Use



● Hause Holomatic Double End machines are designed specifically to perform *two or more* drilling, tapping, threading, reaming, thread rolling, chamfering, spot facing—or similar operations *at one time.*

Holomatic units use factory air supplies for thrust power and a self-contained hydraulic system provides positive, infinitely adjustable control of the rapid travel and feed movements of the quill.

A Holomatic Double End machine efficiently handles parts up to 35" long by 18" in diameter. Capable of drilling ⅜" in mild steel, tapping ¾" —16 and cycling speeds up to 3600 full length strokes per minute. Easy to set up using standard air clamps, index tables and other part locators.

A Holomatic Double End machine in your plant will quickly pay for itself—even on low quantity production work. Investigate the many advantages of the Holomatic system—now!

● *Write today for complete information plus an actual obligation-free Holomatic demonstration in your plant.*

Hause MACHINES, INC.
MONTPELIER, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 1933

New CATALOG

WM. SOPKO & SONS CO.

GRINDING WHEEL ADAPTERS

AND TOOLROOM ACCESSORIES

finest quality ADAPTERS

- Precision-made, Hardened and Ground with Heat Treated Nuts
- Complete Line—4 New Models Available
- For Use on All Popular Surface Tool and Cutter Grinders
- Large Stocks—Immediate Delivery

USE SOPKO ADAPTERS—SAVE TIME, TROUBLE AND MONEY

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Please send your New Free Illustrated CATALOG

NAME _____ TITLE _____

COMPANY _____

STREET _____

CITY _____ STATE _____

CIRCLE INFORM-A-GRAM KEY NO. 1941

"HILLCO" TANGENT CHASERS

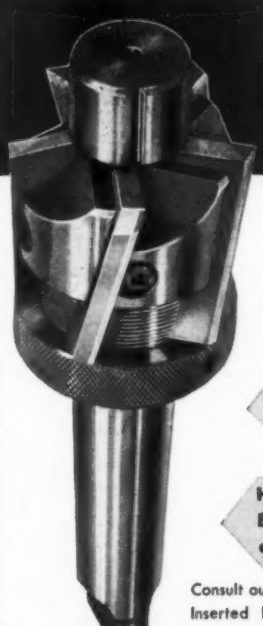
We think you'll agree!

The new line of "HILLCO" Tangent Chasers, which can be re-ground for 80% of their original length, are guaranteed to be of highest grade tool steels ground to exacting tolerances. We feel that this complete line of chasers are the finest that we have produced in our 75 years of cutting tool manufacture. We think that you will agree with us.

THE HILL ACME COMPANY
ACME MACHINERY DIVISION
1203 West 65th Street • Cleveland 2, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 1942

INSERTED BLADE GENESEE FACING AND COUNTERBORING TOOLS



- Interchangeable Pilots
- Constant Chip Space Throughout Life of Blades
- Standard Sizes 1¼ to 4 Standard with Straight or Morse Taper Shanks
- H. S. S.—Carbide Tipped Blades. Save 25% or more over cost of Solid Tools

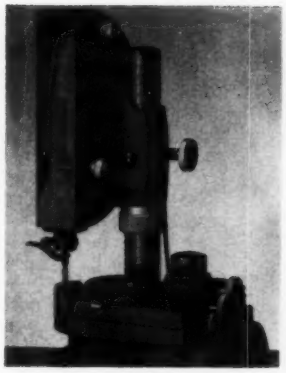
Consult our Engineering Department on your Inserted Blade Production Tool Problems.

WRITE FOR CATALOG 54P

GENESEE MANUFACTURING COMPANY
566 HOLLENBECK ST. • ROCHESTER 21, N. Y.
Adjustable Hollow Mills • Facing and Counterboring Tools • Special Production Tools • Since 1908

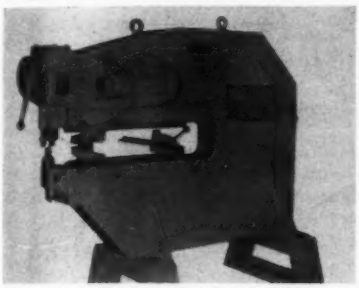
CIRCLE INFORM-A-GRAM KEY NO. 1943

A Simple and Inexpensive Internal Gage is available from Opto-Metric Tools, Inc., 137 Varick St., New York 13. The Leitz Internal Tolerator gage has a semi-optical mechanism with a 1000:1 magnification. Bores between ¼" and 3½" dia and up to ¾" deep may be gaged. The three-handled lever offers feed control allowing convenient feed positions.
Circle No. A53.

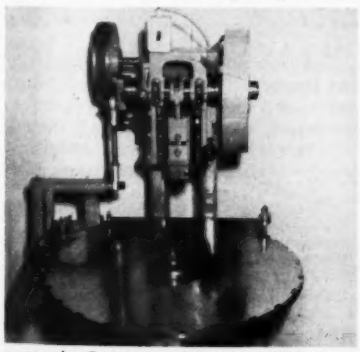


Measure Internal Diameters and check out-of-round, taper, barrel, or bell-mouth with the Sunnen PG-800 precision gage. Entirely self-contained, the gage requires no air or electric connectors. Other features include accuracy to within 20 millionths of an inch, 1000:1 magnification and linear scale over full range. Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.
Circle No. A56.

A New Cutting Machine has been added to the line of universal plate and sheet working machines. Model P-9 has a cutting capacity of ⅜" in mild steel plate and ¼" in stainless steel plate. The new type of stroke length adjustment permits eight different stroke lengths from 0.080" up to 0.320", and operates at 500, 1,000, and 2,000 spm. The machine is capable of straight, circle, and irregular shearing operations in addition to slot cutting, beading, etc. American Pullmax Co., Inc., 2455 N. Sheffield Ave., Chicago 14.
Circle Inform-A-Gram No. A54.



The 1-A Back-Geared Press is used mainly for assembly work and safety is a big feature because the operator's fingers are not under the dies. The indexing tables are available in 12" 30", and 36" dia, the capacity of the press is 5 tons with the dial feed attachment, and strokes up to 5". For additional information contact Perkins Machine & Gear Co., Warren, Mass., or —
Circle Inform-A-Gram No. A55.



from **to** **in 9 seconds**

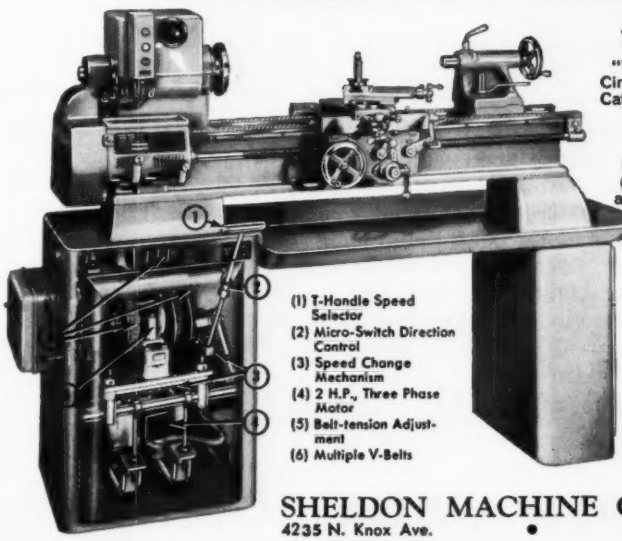
or to *any* intermediate speed, *instantly*

Just raise or lower the T-handle control, and watch the large tachometer dial in the headstock! It's that easy! The work is done by a power driven speed changer. It accelerates or slows the lathe to any desired speed in seconds. With a 10:1 ratio, this new variable drive makes it easy to select from a wide range of speeds —200 to 2000 rpm in direct drive and 40 to 300 rpm in back gear.

Maximum stability and smooth power transmission are assured because the drive unit is oversized. All pulleys and shafts are fully supported (eight bearings). Double V-belts throughout the drive eliminate slippage and deliver full power to the spindle. Because of this rigidity and extra pulling power, this lathe will take heavy cuts at all speeds and precision finish cuts at high speeds.

It is a precision lathe, moderate in price, with the versatility for toolroom, production or second operation jobs.

SHELDON *Variable Speed* **PRECISION LATHES**

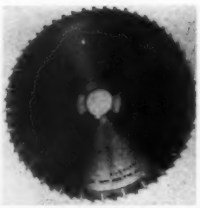

(1) T-Handle Speed Selector
(2) Micro-Switch Direction Control
(3) Speed Change Mechanism
(4) 2 H.P., Three Phase Motor
(5) Belt-tension Adjustment
(6) Multiple V-Belts

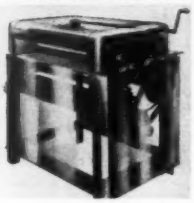
Write for
"Variable Speed" Circular and General Catalog showing . . .
•
10", 11" and 13" SHELDON Precision Lathes (Bench, Pedestal and Cabinet types)
•
13" and 15" SEBASTIAN Geared Head Lathes
•
SHELDON Milling Machines
•
SHELDON Back Geared Shapers

SHELDON MACHINE CO., INC.
4235 N. Knox Ave. • Chicago 41, ILL.

CIRCLE INFORM-A-GRAM KEY NO. 195

Greater Accuracies In Lathe Work are simplified with the 956 tailstock dial. It provides precision control of the movement of the tailstock on lathes and is supplied complete with reference pointer and self tapping screw. Other features include precision cut graduations and scientific line length for greater readability. Lloyd Tool Corp., P.O. Box 647, Burbank, Calif.
Circle No. A57.





A Line of Milling Cutters for Sawing and for cutting narrow, accurate slots is offered by Apex Tool & Cutter Co., Shelton 26, Conn. These thin, alternate-angle milling cutters are forged of high speed steels and reinforced bodies are forged nicked alloy steel.
Circle Inform-A-Gram No. A58.

Adaptable to Soft Materials as well as steel is the Benchmaster straightening machine. It contains 11 gear driven rolls instead of 9. Capable of decoiling steel stock which is 0.010" to 0.200" thick and 48" wide. Benchmaster Mfg. Co., 1835 W. Rosecrans, Gardena, Calif.
Circle Inform-A-Gram No. A59.

Eliminate Multiple Setups and High Costs in heavy milling and boring using the Televersal head. It has a quill which, with the head assembly, can telescope in or out of the body as well as rotate. The G. A. Gray Co., 3611 Woodburn Ave., Cincinnati 7, Ohio.
Circle Inform-A-Gram No. A60.

The Magnesium Height Block is one in the line of lightweight inspection equipment announced by the Challenge Machinery Co., Grand Haven, Mich. It is about ¼ the weight of standard semi-steel equipment, is faster and easier to use, and often saves using extra men or power hoists.
Circle Inform-A-Gram No. A61.

Designed and Engineered for Drilling Hardened Steels, carbide harduty drills can be economically used in hardened die steel without annealing, reworking, and rehardening the parts machined and in most cases

eliminate reaming. They are also used for penetrating hard outer cases and drilling intricate parts. Sizes in stock range from 1/16" through ¾". Chicago-Latrobe, 411 W. Ontario St., Chicago 10, or —
Circle Inform-A-Gram No. A62.

DEPENDABLE

THREAD FORM ACCURACY on Lincoln plug and ring gages is carefully controlled. If the thread form is out of specified limits, the gage may give a false check even though the pitch diameter is within the required tolerance. Such a check could result in finished parts not assembling or failing to operate properly. Our close attention to thread form and all other vital specifications is the reason our customers say, "We can DEPEND on LINCOLN GAGE COMPANY."

MAXIMUM SIZES thread plugs—16" outside diameter. Thread rings 12¼" inside diameter.

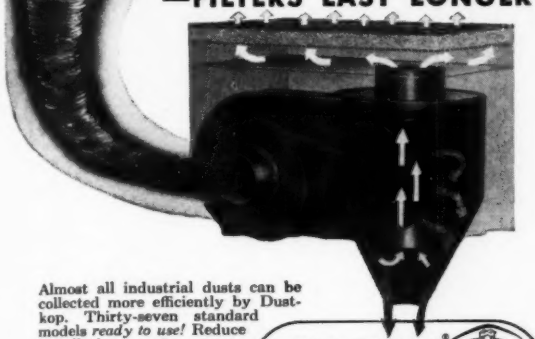
LINCOLN GAGE COMPANY

23906 Harper Ave.
St. Clair Shores, Mich.

CIRCLE INFORM-A-GRAM KEY NO. 196

CYCLONE SEPARATION

FOR MORE EFFICIENT DUST COLLECTION —FILTERS LAST LONGER



Almost all industrial dusts can be collected more efficiently by Dustkop. Thirty-seven standard models *ready to use!* Reduce installation costs — save space. Write for descriptive literature.

DUSTKOP STOPS DUST

ALSO A COMPLETE LINE OF MIST COLLECTORS

AGET MANUFACTURING COMPANY
1394 EAST CHURCH ST., ADRIAN, MICH.

CIRCLE INFORM-A-GRAM KEY NO. 1971

MILLING MACHINE SPACING COLLARS

SAVE TIME

ON GANG MILLING SET - UPS

These MICROMETER ADJUSTABLE SPACING COLLARS are designed for accurate spacing of side milling cutters, gang milling and various other multiple setups on milling machines. Accurate spacing of the milling cutters is easily made by merely loosening the cutter arbor nut and making a plus or minus adjustment.

You will be assured of a QUICK, ACCURATE and POSITIVE ADJUSTMENT at all times.

For immediate delivery specify size and mail orders to . . . . . .

Size of Cutter Arbor	Maximum Outside Diameter	Price
⅜	1-9/16	$12.75
1	1-13/16	12.75
1¼	2-1/16	13.25
1½	2-7/16	13.25
1¾	2-3/4	16.75
2	3-1/16	19.50

DAYTON ROGERS Manufacturing Company

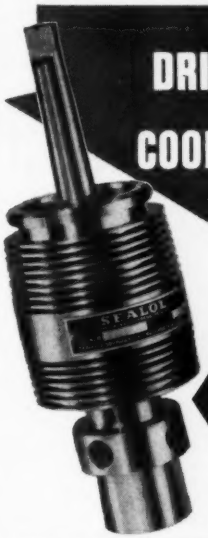
MINNEAPOLIS 7B, MINN.

CIRCLE INFORM-A-GRAM KEY NO. 1972

DRILL PRECISION HOLES IN ONE PASS

Gun Drilling Does It

WITH SEALOL'S **DRILL ADAPTOR** AND **COOLANT SUPPLY UNIT**

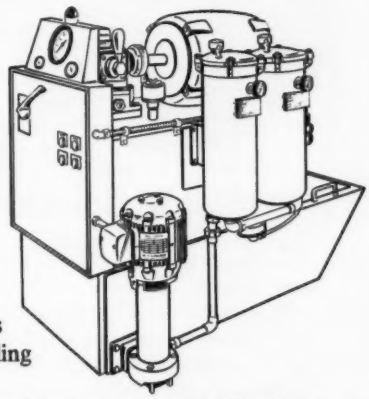


Deep or shallow precision holes in one pass . . . without those profit-cutting steps of boring, reaming or honing.

SEALOL DRILL ADAPTOR — converts your regular, solid-spindle drilling equipment for precision gun drilling of all types.

Transfers coolant from a stationary source to the rotating gun drill at speeds to 10,000 rpm — pressures to 1,000 psi. Coolant is delivered through the gun drill directly to the cutting edge. Work runs cooler; drills cut faster, more accurately and with less power.

SEALOL HI-PRESSURE COOLANT SUPPLY UNIT — provides a high volume of micro-clean coolant at proper pressures and volumes for precision drilling of *all* types.



Filters, cools and pumps coolant to drill adaptor at pressures to 1,000 psi — volume to 40 gpm (higher capacities available) for modern gun or oil-hole drilling.

MAIL THIS COUPON TODAY!

SEALOL CORP

DEPT. T, WARWICK INDUSTRIAL PARK, PROVIDENCE 5, R. I.

Please send me Bulletin information on Sealol gun drilling equipment.

NAME ..... TITLE .....

COMPANY .....

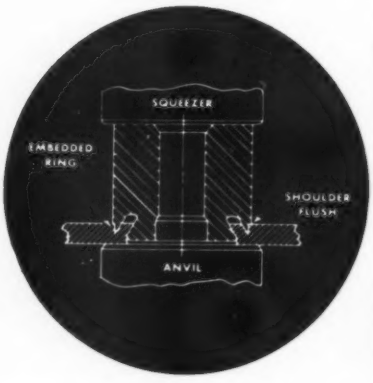
ADDRESS .....

CITY ..... ZONE ..... STATE .....

CIRCLE INFORM-A-GRAM KEY NO. 1973

drop a **PEM Self-Clinching Drill Bushing**

into each on-center hole, and squeeze...



..template's finished

It's that simple—fast—cost-cutting.

There's no riveting, welding, indexing, nesting—no outboard supports.

Compression-clinching locks bushings securely into template metal—even thin gauge, light weight templates.

Alignment and center distances are secured, automatically.

High torque and pull-out resistance.

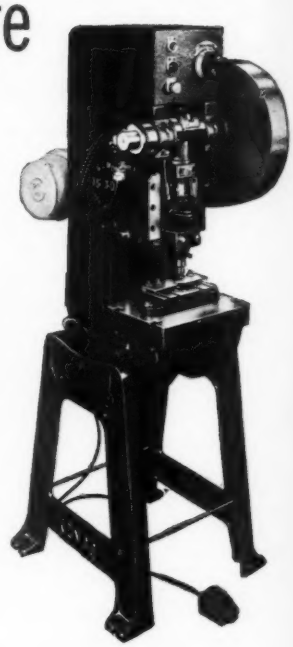
Write for literature and samples. Penn Engineering & Manufacturing Corp., Doylestown, Pa.

PEM

CIRCLE INFORM-A-GRAM KEY NO. 1981

KENCO

15-ton Electro-Safe the safest punch press you can buy!



Single-trip control buttons are widely spaced, to keep hands clear of the danger zone. Operators must push *both* buttons at once... hold them until stroke reaches bottom, then release both buttons to start new cycle. Fail-safe operation. Impossible to "fudge." Impossible for press to double trip.

Versatile controls—You can change from "single trip" to "continuous stroke," or "inching" by merely turning a dial. You can change timing in seconds. No flywheel... no clutching. Write for details.

KENCO MANUFACTURING CO. *5211 Telegraph Road, Los Angeles 22, Calif.*

CIRCLE INFORM-A-GRAM KEY NO. 1982

144 ABRASIVE WHEELS & POINTS

BRAND NEW PERFECT FIRST QUALITY MOUNTED ON ⅛" STEEL MANDRELS

ONLY $28.50 POSTPAID IN U. S. A.

IMPORTED

Complete--In Sturdy, Handy Container

List Price **$93.60**

OUR PRICE

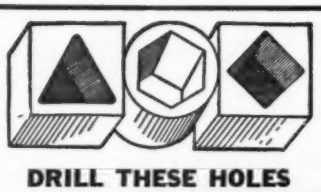
You Save **$65.10**

Ideal for ALL INDUSTRIAL PURPOSES. Brand-new GUARANTEED PERFECT and first quality. Included in the assortment are 16 SIZES—9 NUMBERS OF EACH mounted on ⅛" shanks. If after 10 days you are not fully convinced that this is the greatest wheel and point value in the industry, return the set at no cost or obligation on your part.

Illustrated Catalog Free on Request.

SCHUPACK SUPPLY COMPANY
7331 Cottage Grove Ave. Chicago 19, Ill.
Dept. TP-8

CIRCLE INFORM-A-GRAM KEY NO. 1983



DRILL THESE HOLES
BY A QUICK, EASY, INEXPENSIVE METHOD
Your business letterhead will bring literature.
WATTS BROS. TOOL WORKS
Wilmerding, Penna.

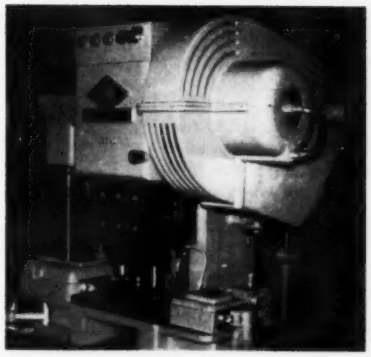
CIRCLE INFORM-A-GRAM KEY NO. 1984

JIG BORING
and
Large Precision Machining
Done to your specifications
We Have
21 Jig Borers
KIDDE PRECISION TOOL CORPORATION
10 Locust Ave., Roseland, N. J.

CIRCLE INFORM-A-GRAM KEY NO. 1985

The No. 17.000 Tapping Head has positive drive and is ball bearing mounted. Housing is cast aluminum and all shafts, gears, and chuck are of alloy steel, heat treated and ground. Engagement of forward and reverse is through positive jaw clutches. Burg Tool Mfg. Co., Inc., Bardena, Calif.
Circle Inform-A-Gram No. A63.

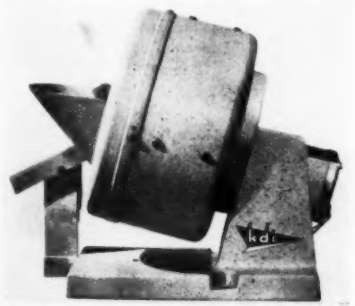
Save ⅓ on Costs and Set-Up Time with a Multi-Autoformer. Model 3T10 also is entirely automatic in operation which requires ¾ less direct labor time. Other features include plug-in modular tooling permitting standard punch and die elements; average set-up time is 45 min including breakdown of last set-up and feed tool adjustment; and operating speed adjustable ranges from 250 to 800 parts per min. Multi-Autoform Corp., 432 W. Laurel, Glendora, Calif. ,or —
Circle Inform-A-Gram No. A66.



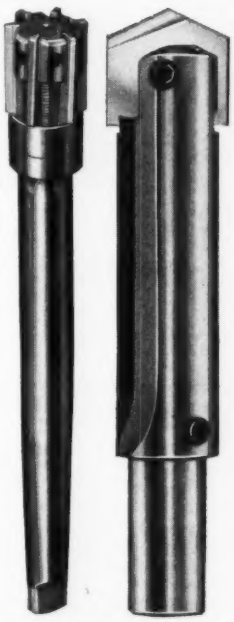
More Efficient Liquid Removal and a wider pressure and temperature operating range are features of a new metal bowl automatic-drain air line filter. It is designed for applications

that must withstand rough usage. This filter provides an operating pressure range from 5 to 250 psi, draining automatically as long as there is pressure in the air system. C. A. Norgren Co., 3400 S. Elati St., Englewood, Colo., or —
Circle Inform-A-Gram No. A64.

High-Rate Orienting and Feeding of Small Metal and Plastic Parts is done by the KDI 110 special drum hopper. This feeder can be quickly and easily tooled to feed headed fasteners, nuts, rivets, wire terminals,



light electrical components, and other small metal and plastic parts at rates up to 150 pcs/min. KDI Corp., 950 Exchange St., Rochester 8, N. Y., or—**Circle Inform-A-Gram No. A65.**



Inserted Blade Reamers carried in stock from ⅝" to 6" diameter with either carbide tipped or H.S.S. blades.

Spade Drills carried in stock from 1-1/16" to 5" diameter.

E-X-P-A-N-D-E-D

FACILITIES

Waukesha Cutting Tools, Inc. has moved into new and larger quarters to provide additional space for the modern, precision machine tools which have been acquired to better serve the needs of its customers.

Cut Costs with Standard Tools

Drilling costs can be sharply reduced through the use of Waukesha Standard Spade Drills. Each holder accommodates a wide range of blade sizes thereby holding both the original cost and *total tooling investment* to a minimum.

Waukesha also designs and manufactures Special Reamers and Special Spade Drills to meet those unusual requirements in which standard Waukesha Cutting Tools cannot be used.

Consult Waukesha for Competent Counsel on your Metal Cutting Tool Requirements.

Write for latest catalog describing and illustrating the Full Line of Waukesha Tools.

WAUKESHA CUTTING TOOLS, Inc.

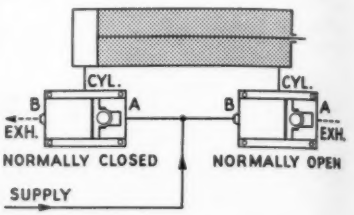
Midland and Pearl Streets • Waukesha, Wisconsin

A7-9256-½I

A Line of Dotco Rotary vane type pneumatic die grinders is announced by Doeden Tool Corp., Sherwood, Ohio. Specifically designed for contour finishing and grinding of dies, molds, patterns, forgings, and castings, it is also used for deburring machined parts. Model 1GL with lever control is used with carbide burrs ½" and smaller diameter, ¾" dia vitrified, and 1" dia organic wheels, or with flexible disc holder for sanding discs up to 1½" dia.
Circle Inform-A-Gram No. A67.

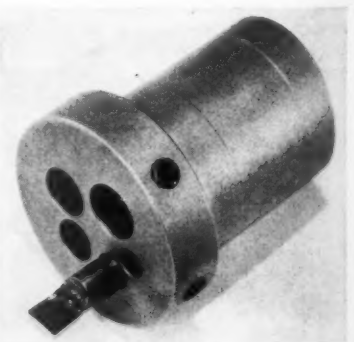
A Replaceable, Stud Taper Combined Drill and countersink extension has been developed for vertical and horizontal boring mills, jig bores, and drill press. It is used also in conjunction with fixtures utilizing bushings to guide the adaptors for spotting holes and centering parts. Center drill sizes are ⅛" through ⅝" dia and adaptor lengths are 3½" through 7½" in standard 1" increments. Unidapt Co., 945 E. Ten Mile Rd., Hazel Park, Mich., or —
Circle Inform-A-Gram No. A68.

Provide Greater Valve Versatility and simplify piping with the No-Pack-Matic pilot operated poppet-type air control valves. They feature the automatic Flow Director pilot head. This is a system of ball checks and automatically picks up pilot pressure from whichever port is used as the inlet and directs it to the pilot valve. These pilot heads are interchangeable on all valves, ¼" through ¾" pipe sizes. Galland-Henning Nopak Div'n, 2787 S. 31st St., Milwaukee 46, or —
Cricle Inform-A-Gram No. A69.



SUPPLY TO PORT "A"-VALVE NORMALLY CLOSED
SUPPLY TO PORT "B"-VALVE NORMALLY OPEN

Save 300% to 600% on Cost of Bushings for turret lathes with the T-K multiple boring bar holder. The type 1½" bushing adapts ¼", 5/16", ⅜", 7/16", and ½" in the same holder. These bushings are easily used without removing them from the machine by revolving and setting proper set screw. Made of ductile iron and hardened to RC 60-62, these bar holders save set-up time and solve lost bushing problems. J. Olson Machine Co., Inc., 2746 31st Ave. South, Minneapolis 6, Minn., or —
Circle Inform-A-Gram No. A70.



Foster Automatic Control
Reduces Scrap & Improves Quality

mounts on any grinder to solve your external cylindrical grinding production problems

Foster Electrosizer assumes complete control of the actual grinding cycle and eliminates the human element of error in production grinding. Close tolerances are held consistently. Wheel life is increased by consistent grinding speed.

It's compact and readily installed on most any hydraulically or electrically operated machine and is so simple in concept that set up and size change is a matter of seconds.

Can be readily adapted for full automation.

1
Operator engages caliper, cocks gage, and advances the wheelslide.

2
Machine grinds at fast feed until within a few thousandths of exact size.

3
The gage signals the machine to reduce grinding speed and go into extremely fine feed. This improves finish and corrects any out-of-round condition.

4
When size is reached, gage signals the wheelslide to retract.

ALSO
Foster Visual Control
and Snap Gages

Write for full information

FOSTER
ENGINEERING
CORPORATION
4200 N. Woodward
Royal Oak, Mich.

NOW! you can afford rapid, precision optical inspection

COVEL Optical Comparator

Only $985.00

Now every shop can enjoy the advantages of precision optical gaging and inspection. Covel No. 14 Optical Comparator outmodes mechanical checking methods, prevents costly errors, saves time and money!

The Covel Comparator is easy to use, even in brightly lighted shop areas. Has large 14" diameter screen and 6" horizontal stage travel. Rugged, precision construction throughout.

SEND FOR DESCRIPTIVE BULLETIN TP-97

COVEL | PRECISION GRINDERS
BENTON HARBOR, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 2011

STUBBORN
broken pipes, studs, and screws easily removed . . .

WITH REPS PIPE & STUD EXTRACTORS
MAKES STRONG FOUR POINT GRIP WITHOUT HAMMERING

In sizes for every pipe ⅛" to 2", every stud and screw ⅜" to 3½".

A specialized tool that creates a powerful pulling bite without reaming. Hardened steel—will remove any material.

Take advantage of Walton's 30-day free trial to investigate the labor savings that this simple specialized tool can effect in your shop. Write for Data Folder #38 giving complete details.

The WALTON Company
HARTFORD 10, CONN.

CIRCLE INFORM-A-GRAM KEY NO. 2012

FREE... 64 PAGE CATALOG

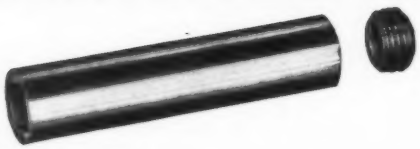
WORLD'S LARGEST LINE OF WORK HOLDING EQUIPMENT—CHUCK JAW BLANKS, CAST ALUMINUM AND MALLEABLE KNOBS, WHEELS, HANDLES—PLUS HUNDREDS OF OTHER JIG AND FIXTURE COMPONENTS

COMPLETE DETAILED SPECIFICATIONS
ENGINEERING DRAWINGS • COST SAVING DATA
write for your copy—TODAY!

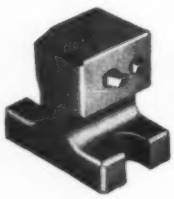
JERGENS TOOL SPECIALTY CO.
Dept. TP-9 712 E. 163rd St., Cleveland 10, Ohio

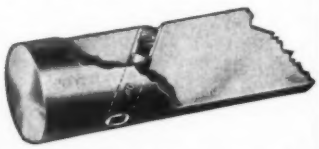
CIRCLE INFORM-A-GRAM KEY NO. 2013

How SQUARE HOLED SLEEVES SPEED UP TOOL-MAKING!



One of the most difficult problems in tool making can be solved easily and quickly with Sturdy Square Holed Sleeves. The perfection of broached square holes can be had in boring bars, milling cutters and many other applications at a small fraction of the cost of imperfect hand-made square holes. The Sturdy Square Holed Sleeve consists of a round sleeve with a perfectly square hole broached through the center. This hole is tapped at one end to receive a back-up screw which is furnished with the Sleeve. The Sleeve can be sweated or pressed into a drilled and reamed hole to make a perfectly square accurate hole in a very few minutes.





The Sturdy Square Holed Sleeve will save you many hours and many dollars in the making of boring bars, tool holders and other tools requiring square holes.

SLEEVES MADE IN FOLLOWING SIZES:
3/16, ¼, 5/16, ⅜, 7/16, ½, ⅝, ¾, 1"

STURDY BROACHING SERVICE, INC.
23516 TELEGRAPH RD., DETROIT 19, MICH.

Write for Literature

CIRCLE INFORM-A-GRAM KEY NO. 2021

LAYOUT FLUID
IDEAL FOR TOOLMAKERS & MACHINISTS

TRIAL OFFER

Send me my order of D-R LAYOUT FLUID right away! Bill me ☐ Bill my company ☐
Name
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Address
City Zone State

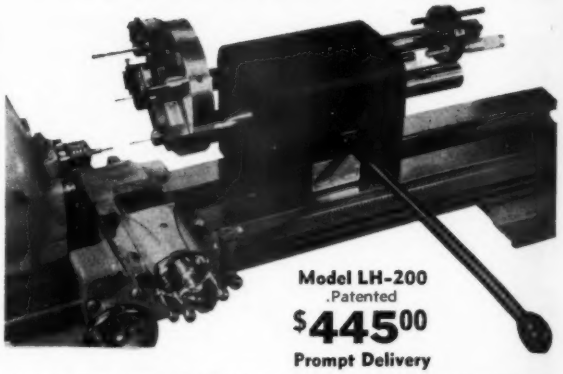
2 FOUR OZ. "BRUSH-IN-CAP" CANS
$1.00

DAYTON ROGERS *Manufacturing Company*
MINNEAPOLIS 7B, MINNESOTA

CIRCLE INFORM-A-GRAM KEY NO. 2022

SAFE • FAST • ACCURATE • PROFITABLE

New CONCENTRICITY HEAD *with* MICROMATIC CONTROL



Model LH-200
Patented
$445.00
Prompt Delivery

LH-200 EXCLUSIVE FEATURES:

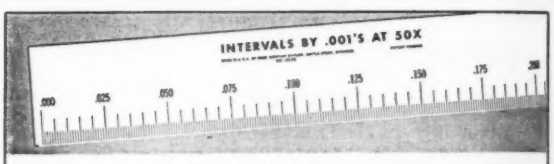
- Finished parts from the rough to a precise tolerance.
- Micromatic control for your micro drilling convenience.
- From one lathe to another in 20 minutes for 6" swing and up.
- One adjustable master pilot for accurate indexing.
- No floating or adjustable holders required for misalignment.
- A new lock stop for fast precise setting.
- Six ⅛" dia. bores for accurate tooling.

GUARANTEED TO SATISFY OR YOUR MONEY BACK!

The HAWKEYE Company has a complete line of accessories for the LH-200.

HAWKEYE SPECIALTY CO. 1532 West 14th Street Davenport, Iowa

CIRCLE INFORM-A-GRAM KEY NO. 2023



Gage Company **PRECISION PLASTIC**
COMPARATOR SCALES

Non-breakable...accurate...designed for making quick measurements at scale on projectors and comparators without any movement of machine or work.

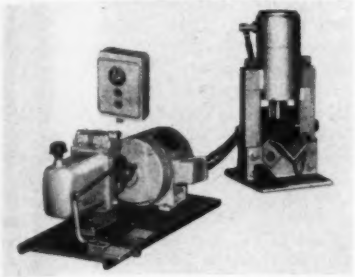
An unexcelled tool for use in drafting and constructing scale layouts for comparator chart use. All standard magnifications and various styles for every application.

WRITE FOR BULLETIN NO. 54-1511

GAGE COMPANY
BATTLE CREEK, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 2024

For Use in Sheet Metal Shops, by steel fabricators and maintenance departments is a hydraulic operated angle iron shear. The shear is operated by a foot treadle, and the blade is always under the complete control



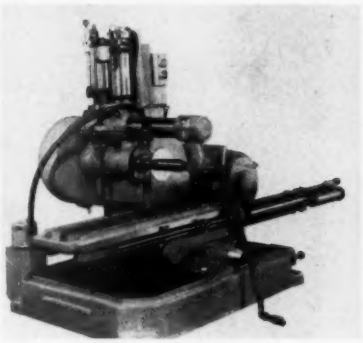
of the operator. The machine has a capacity of 4" x 4" x ¼" angle iron, ⅜" x 3½" flat, ⅝" round, ½" square bars, or 1" hollow square tubing with regular angle iron shear blades. W. A. Whitney Mfg. Co., 636 Race St., Rockford, Ill., or —
Circle Inform-A-Gram No. A71.

Simplify Production of Long Tapered Tubular Products with the swaging machine. Model 4½F will produce tapers up to 15" long on tubing up to 2¼" dia in a single pass and at a production rate up to 6 per min. This includes welded and seamless tubing of ferrous and nonferrous materials from stainless to aluminum. Fenn Mfg. Co., Fenn Rd., Newington, Conn., or —
Circle Inform-A-Gram No. A72.

A Technique Dynamically Measures Electrical Characteristics in Transistors. This enables the circuit designer to simultaneously examine a series of electrical parameters in the circuit laboratory. Employing a

multi-purpose switching circuit composed of two transistors, this examination technique permits quantitative measurements using a calibrated oscilloscope for rapid design analysis. Cubic Corp., 5575 Kearney Villa Rd., San Diego 11, or —
Circle Inform-A-Gram No. A73.

Flexibility, Power, and Ruggedness are features of the half-mill, a production or toolroom milling machine. Applications for the half-mill range from use as an independent head mounted on any base to that of semi-automatic machining with air hydraulic head and table feeds. Slotting, sawing, face milling, keyway cutting, slab milling, forging, and other operations may be handled with the unit. U. S. Burke Machine Tool Div'n, Brotherton Rd. & Pennsylvania Railroad, Cincinnati 27, or —
Circle Inform-A-Gram No. A74.



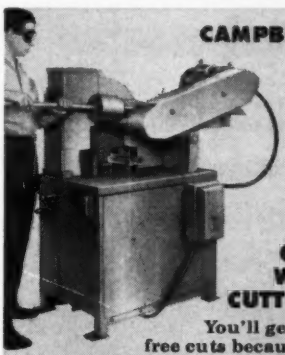
Campbell
Abrasive Cutting Machines

Abrasive Cutting Know-How

Know-How is just as vital to top performance in abrasive cutting as in any other machine tool operation

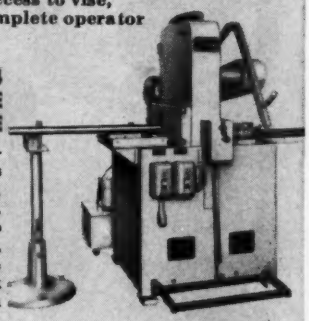
These Campbell Abrasive Cutting Machines are Ideal for Job Shops

CAMPBELL #28 DRY CUTTING MACHINE



You can cut up to 4" square solids, 6" angles, 8" channels, and 4" diameter tubing. Wheel-oscillation permits cutting of large sections without burn—at a rate of 2 to 5 seconds per square inch. "Swing-away" wheel guard permits unobstructed access to vise, but provides complete operator protection.

CAMPBELL #64 WET ABRASIVE CUTTING MACHINE



You'll get accurate, burn-free cuts because of CAMPBELL's ideal coolant application, wheel guides, wheel oscillation, and ample power. A versatile vise firmly holds all shapes up to 3" diameter steel bars, 4" diameter tubing, and 6" x 1" plate—for cuts at the rate of 6 to 10 seconds per square inch. A quick setting work-stop swings with the vise for angle cuts to 45°.

ABRASIVE CUTTING OFFERS YOU—

Versatility • Single piece of equipment cuts tool steel, structurals, tubing, heat-resistant alloys, and new "wonder metals," with quality and accuracy.

Economy • High production rates, negligible set-up time, elimination or reduction of annealing and deburring reduce labor costs —save production space.

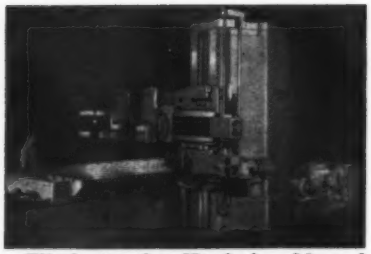
For further information write for the illustrated Bulletin DH-460-B

ACCO

CAMPBELL MACHINE DIVISION • American Chain & Cable

927 Connecticut Avenue, Bridgeport 2, Connecticut

CIRCLE INFORM-A-GRAM KEY NO. 203

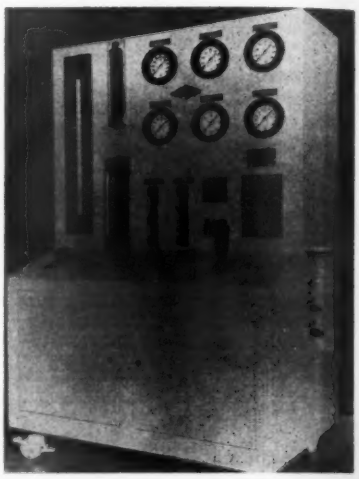


Eliminate the Need for Manual Positioning while setting up the machine by using the heavy duty deluxe hydraulic planer with 2-speed traverse motors. This machine has power rapid traverse, power rail elevation, automatic power rail-lock, and automatic way lubrication. A one piece L shaped rail construction assures continued accuracy. Rugged sidehead and railhead construction permit maximum utilization of the proper tool for each specific job. Rockford Machine Tool Co., Rockford, Ill., or —
Circle Inform-A-Gram No. A75.

A New Midg-A-Matic Self-Feed Air Drill, only 1" in dia and 10 3/16" long, is announced by the Aro Equipment Corp., Bryan, Ohio. This tool drills holes automatically with a

capacity to 1/16" holes and under. It can be used singly or in multiples. Low center-to-center distance aids use where space is a factor and the drill operates with low air consumption. Speed is 20,000 rpm with stroke length 1 3/8".
Circle Inform-A-Gram No. A76.

Reduce Pneumatic Checkout Time by as much as 80% with a series of universal pneumatic test stands. They provide regulated air pressures at various levels from 0 to 500 psi and

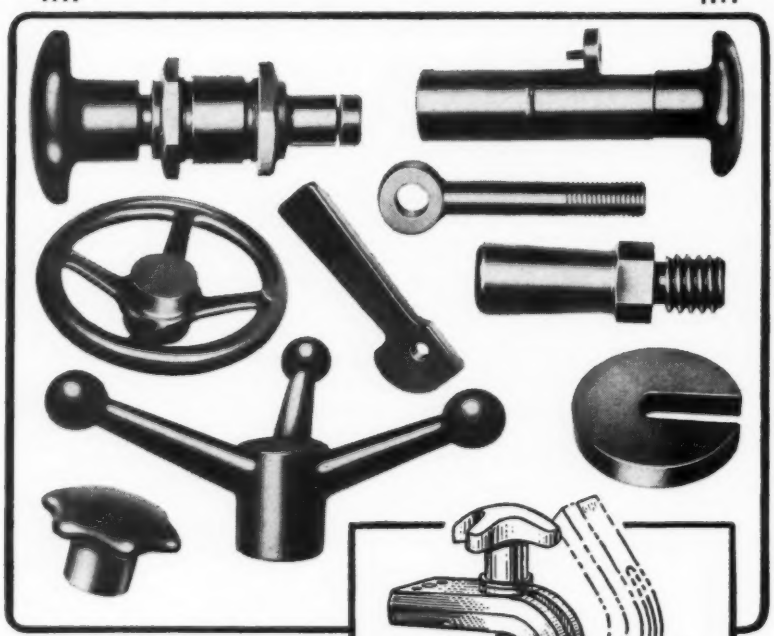


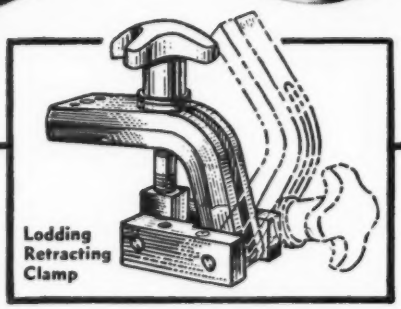
accomplish final assembly line testing of all compartments, systems, and components within this range. Through closed circuit design and the use of differential type controllers, all pressures are read as they occur. Kinetrol Co., 5543 Dyer St., Dallas 6, Texas.
Circle Inform-A-Gram No. A77.

A Line of Plastic Pallets, skids, shipping trays, assembly line trays, and flexible stacking paltiers has been announced by The Paltier

Corp., 1701 Kentucky St., Michigan City, Ind. They are designed to meet rugged operating requirements and have tensile and impact strength.
Circle Inform-A-Gram No. A78.

You Cannot Afford To Make Your Own





Standardized Components that a toolmaker would take hours or days to make, are ready for you at your Lodding distributor.

Four sizes each of four styles — hand knob, hand cam, nut and air operated.

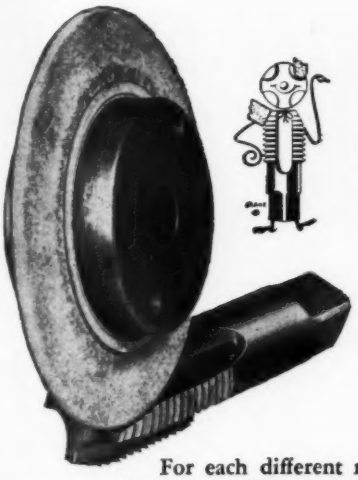
LODDING, INC.
WORCESTER 1, MASS.

Precision Tool Sales
417 E. Florence Ave.
Los Angeles 3, Calif.

FACTORY WAREHOUSES

Bagby Engineering Co.
1047 Forest Ave.
Evanston, Ill.

CIRCLE INFORM-A-GRAM KEY NO. 204



For Profitable Tapping, Grind Your OWN Best Rake Angles!

Controlled grinding of tap flutes and chamfers.

For each different material, there is a "best" rake or hook angle for tapping. You can grind and re-grind this angle on taps for each of your jobs . . . positively and accurately, time after time . . . with the BLAKE Flute Grinder.*

Combined with the BLAKE Chamfer Grinder, this machine can give you substantial savings even with Class 3 or 4 fit standards, because you will have:

1. Best rake or hook angle for the material tapped.
2. Exact indexing of cutting edges.
3. Correct spiral points.
4. Accurately relieved chamfers.

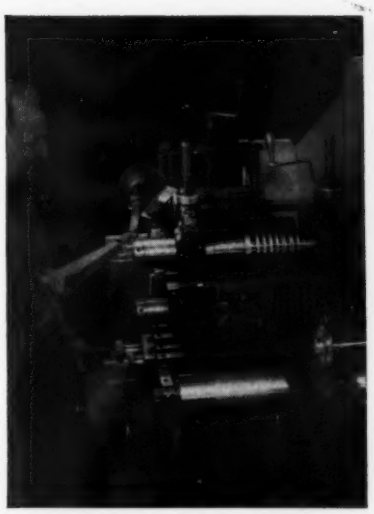
The increased uniformity and accuracy of your threads, plus *far* greater tap life, are the sound basis for maximum savings in your tapping costs.

Ask us for the details of what this combination can do for you.

**Now available with air operated vertical slide.*

EDWARD BLAKE COMPANY INC.
MANUFACTURERS OF FLUTE AND CHAMFER GRINDERS
442 CHERRY ST., WEST NEWTON 65, MASS.
Exclusive Distributors of:
BLACK DIAMOND PRECISION DRILL GRINDERS • SURFACE FINISH STANDARDS • WORCESTER DRILL GRINDERS

CIRCLE INFORM-A-GRAM KEY NO. 2051



YODER SLITTERS Supply Varied Strip Widths for Tinnerman *Speed Nuts*®

Tinnerman Products, Inc., Cleveland, Ohio, produces more than 10,000 different shapes and sizes of "SPEED NUT" brand fasteners for industry . . . many of them to special specifications.

To do this, Tinnerman uses slit steel strands ranging in width from ⅛" to 7½". To carry an inventory of the many strip widths required to meet normal and unusual demands would be almost impossible.

Tinnerman overcomes these inventory and supply problems by doing their own slitting on two Yoder slitters. This enables them to supply the plant with any strip size required from a relatively small inventory of 6" and 9" width purchased coils. In slitting narrow strands, such as these from small coils, a Yoder slitter may be profitable on a production as low as 25 tons per month.

Here is a fine example of how a small investment in Yoder slitting equipment greatly simplifies and speeds production while effecting important operating economies.

The saving made in time alone, reflects in better customer service through faster completion and delivery of finished products.

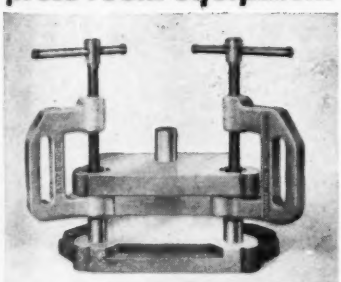
If your steel strip or sheet slitting requirements are as low as 100 tons per month or even less, a medium size Yoder slitter can be a very profitable investment for you. The Yoder line includes units of every size and capacity . . . of the most advanced engineering design. Send for the Yoder Slitter Book —a comprehensive text on the mechanics and economics of slitters and slitting line operation, with time studies, cost analyses and other valuable data. Write to:

THE YODER COMPANY
5501 Walworth Avenue • Cleveland 2, Ohio

ENGINEERING YODER MANUFACTURING
ROTARY SLITTING LINES

CIRCLE INFORM-A-GRAM KEY NO. 2054

economically priced press room equipment



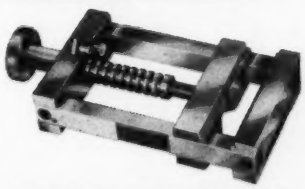
DURANT Die Set Pullers

Easily removes punch holder from die shoe by a straight upward pull, yet protects the die set. 3 Models fit all sizes of die sets. Priced from $18.00 per pair.

WRITE FOR NEW FREE CATALOG
DURANT TOOL SUPPLY CO.
PROVIDENCE 3, RHODE ISLAND

CIRCLE INFORM-A-GRAM KEY NO. 2052

ESSENTIAL



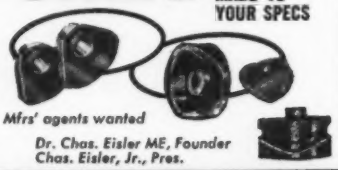
PRODUCTO TOOLROOM VISE

Producto's Precision Toolroom Vise is essential equipment for your jig borers, surface grinders, drill presses, tappers. It's extremely strong, yet weighs only 13 lbs. and has a 2" high frame. Has large jaw opening, will clamp heavy as well as light workpieces. All surfaces hardened and ground. Works on five surfaces. Write for Bulletin TE2-103.

THE PRODUCTO MACHINE CO.
970 Housatonic Avenue
Bridgeport 1, Connecticut

CIRCLE INFORM-A-GRAM KEY NO. 2053

CAMS ALL TYPES MADE TO YOUR SPECS



Mfrs' agents wanted

Dr. Chas. Eisler ME, Founder
Chas. Eisler, Jr., Pres.

EISLER ENGINEERING CO., INC.
732 SO. 13TH ST., NEWARK 3, N. J.

CIRCLE INFORM-A-GRAM KEY NO. 2061

HARDNESS TESTING
has been done with the **SCLEROSCOPE**
Since 1907

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THE SHORE INSTRUMENT & MFG. CO., Inc.
90-35 Van Wyck Expressway
Jamaica 35, N. Y.

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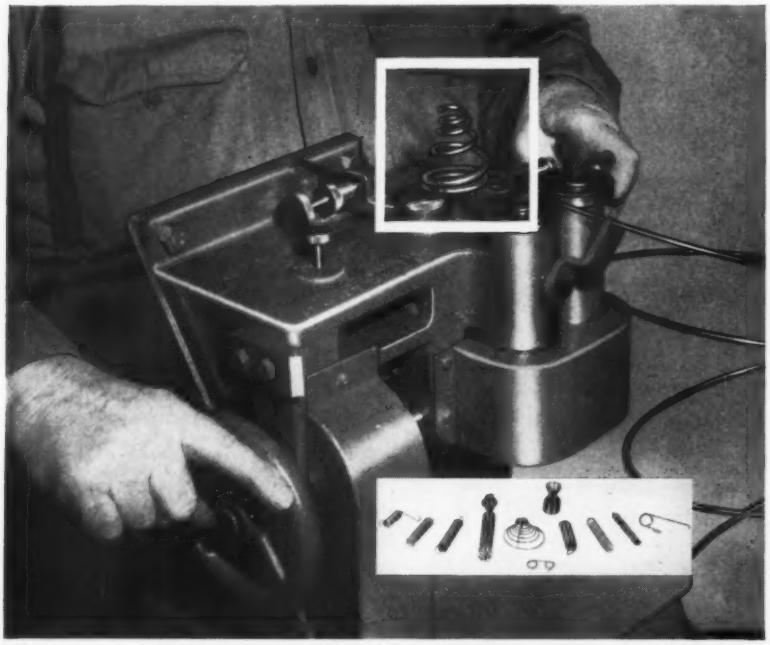
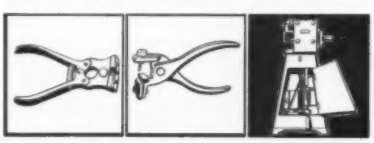


Any spring made fast in your shop!

WITHOUT USE OF ARBORS

For a replacement or experimental spring, any shape, diameter or pitch from flat or round wire sizes .005″ to .125″, you can produce it in a matter of seconds with Perkins Precision Spring Coiler. You eliminate arbors, yet turn out precision springs — torsion, compression, extension, tapered, or special springs, coiled either left or right hand, in any desired length, any diameter from 3/32″ to 12″ and larger, with or without initial tension, and with open or closed ends. Eliminate expensive special orders and costly production delays! Make your own springs to exact specifications as replacements or experimental work. Make them fast, right in your own shop!

PERKINS
MACHINE AND GEAR CO.
Special Machinery Division,
West Springfield, Mass.



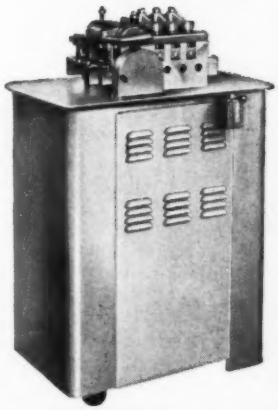
Starret adjustable jaw cut nippers (left) and Gardener Hook-Kon spring looping tool (center) — handy, precision, time-saving accessories for spring coiling. Perkins Spring Coiler available as bench model or power model shown here, (right) for tool shop or continuous runs.

Perkins Machine and Gear Co.
Special Machinery Division, Dept. B2
W. Springfield, Mass.
Please send information and prices on Perkins Spring Coiler.
Hand Model ☐ Power Model ☐

Name.....Title.....
Company.....
Address.....
City.....State.....

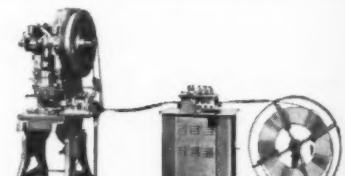
CIRCLE INFORM-A-GRAM KEY NO. 2063

FLEXIBILITY
in Stock Straightening



WITTEK
STOCK STRAIGHTENERS

Used in conjunction with a reel stand and automatic feed for punch presses, the Wittek Stock Straightener is a self-contained, motor-driven unit designed for maximum efficiency in the continuous straightening of coiled stock. Standard models handle stock with widths up to 12 inches. An infinitely variable speed drive permits any desired straightening speed so that the proper slack is maintained in the straightened strip between the unit and the press feed.



This typical Wittek automatic production feeding setup includes—Wittek roll feed mounted on the punch press, Wittek stock straightener, and Wittek self-centering reel stand.

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Production Feeding Equipment

4323 W. 24th Place • Chicago 23, Illinois

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Cut Idle Machine and Operator Time by a possible 40-50% with the Model 24MA milling machine. It features the Van Norman adjustable cutter head which makes possible horizontal, vertical, and angular

milling with just one machine. There are 12 speeds from 40 to 1600 rpm and the cross travel is 12", longitudinal travel 28", and vertical travel 23". Van Norman Machine Co., Springfield, Mass., or —
Circle Inform-A-Gram No. A79.

The Contour Projector has been designed for chart and fixture application, for inspection of machined parts, and other objects by optical gaging. Model 14-6 Kodak contour projector makes fixturing easier and setups faster with table cross travel of 3", vertical travel of 2⅛", and focusing travel is 1½". This projector provides rapid horizontal measurement to the order of 0.0002" for toolroom as well as production use. Optical Gaging Products, Inc., 26 Forbes St., Rochester 11, N. Y., or —
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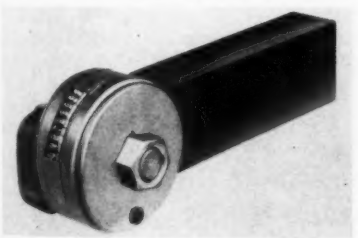
An Improved Insert-Type Tool Die has been developed for turret lathes, engine lathes, and screw machines. This Mecco Safety Insert Tool Die (No. 177) features an improved spring return, which quickly returns the unit to starting position after a



part has been marked. This product can be made for one or more lines of lettering of any number of characters. It can be built with part of the lettering permanent, or with all lettering interchangeable. M. E. Cunningham Co., 1068 Chateau St., Pittsburgh 33, or —
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Measure Flatness with the Lapmaster Monochromatic Light which is four times larger than the present model. The light is 11" x 14" with a work stage size of 10" sq. Heavy duty, 9,000-volt transformer provides an average of 40 ft candle power at diffusing glass. On pieces too large for the work stage to hold, the light head may be swung completely around to permit checking work right on the bench. Crane Packing Co., Dept. TPC, 6400 Oakton St., Morton Grove, Ill., or —
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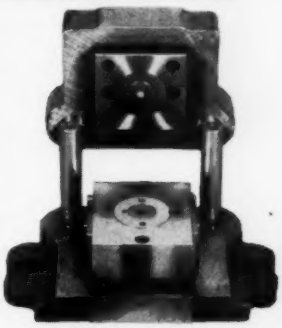

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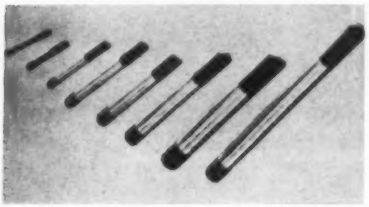
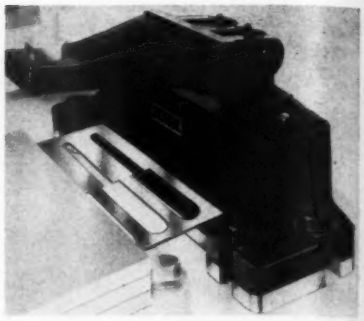


Cut Steel 12" Wide and up to ⅛" Thick Solid Cross Section with the heavy-duty 12" chopper. Although it occupies the same amount of space as ordinary 12" choppers, it handles greater thicknesses. This unit is easily installed, it fits any punch press, and handles any coiled ribbon stock. The blades can be removed quickly for grinding, and installation of spare blades almost eliminates down-time. Other choppers are available to cut stock up to 3/32" thick solid cross section. Jaco Devices, Inc., 96 High St., Hingham, Mass., or—**Circle Inform-A-Gram No. A84.**



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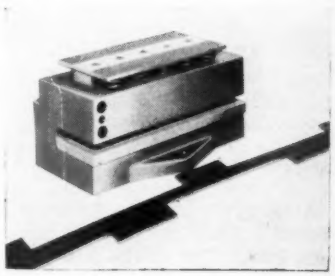

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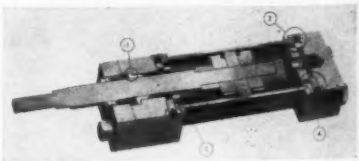

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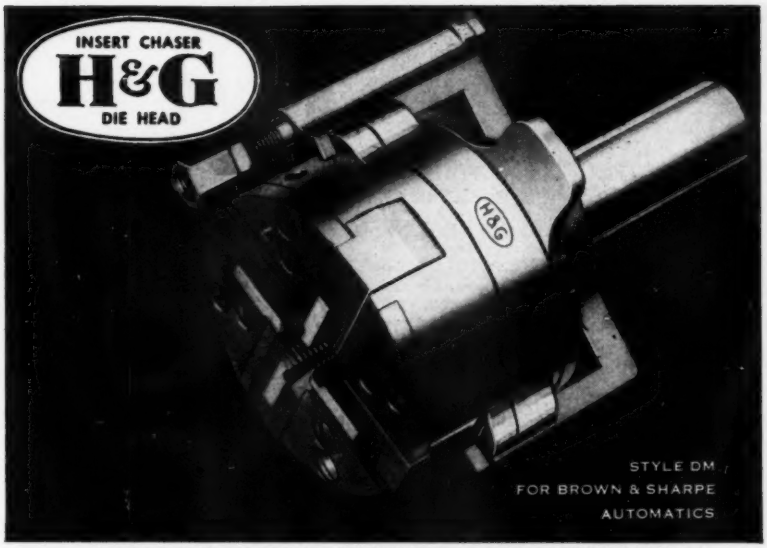

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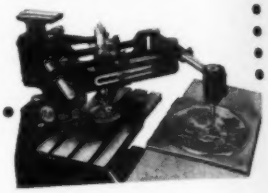

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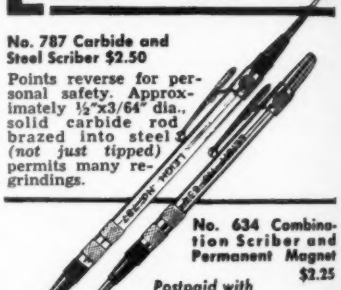

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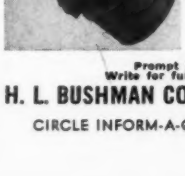

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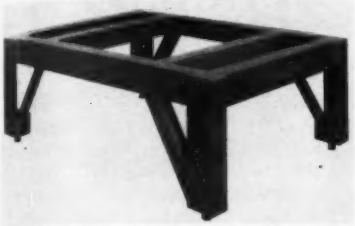

to six times the weight of the respective surface plates. Overall working height of the stands is 36", but can be made at varying heights as specified. Collins Microflat Co., 3249 W. El Segundo Blvd., Hawthorne, Calif., or —
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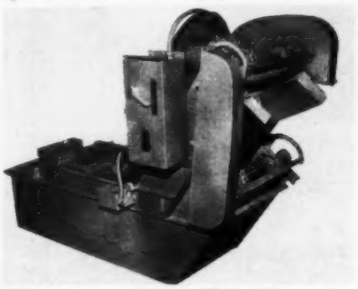

aids or materials. This filter also eliminates maintenance problems. Models are available in capacities from 20 to 1,000 gpm and with filter screen sizes from 0.004 and up. Henry Mfg. Co., Inc., Bowling Green, O., or —
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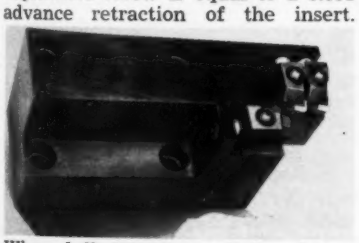

When dull, inserts are indexed to a fresh cutting edge, and since square inserts are used, the inserts can be indexed to 8 different edges before being discarded. Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, or—**Circle Inform-A-Gram No. A89.**

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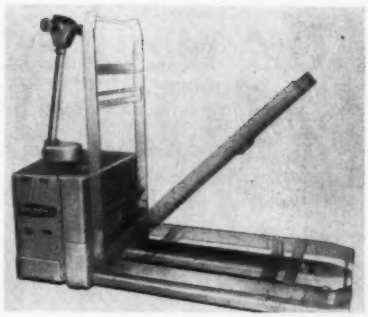

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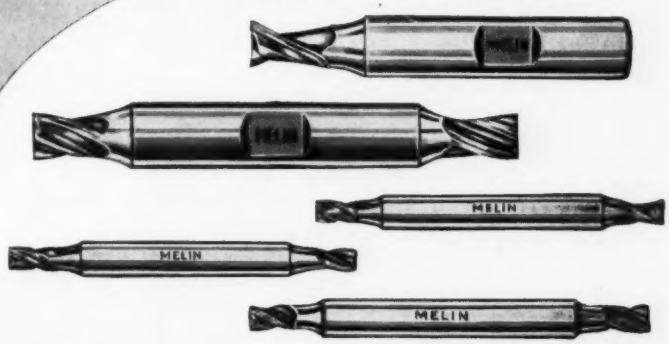

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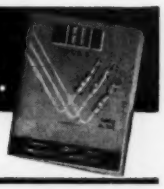

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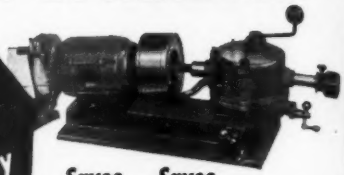

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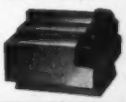

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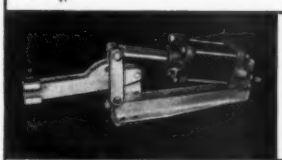


TWO NEW AIR-OPERATED CLAMPS with 800 pound clamping force

AO-800 CLAMP

AODT-800 DOUBLE TOGGLE CLAMP

Because you asked for it, Lapeer's vast line of Knu-Vise clamps now features four distinct groups of air-operated clamps. Two new 800 lb. air clamps have been added to the widely accepted 200, 400 and 1200 lb. air clamps, thereby rounding out the Knu-Vise series. The Model AO-800 clamp is for conventional holding operations—the Model AODT-800 for those difficult mounting situations.

For complete information on these units and the more than 150 other models available, write for catalog today!

Manufacturers of over 150 models of manually and air-operated clamps and pliers

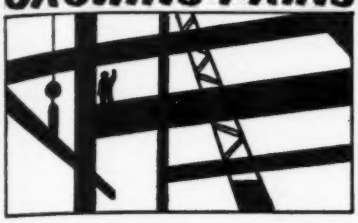
KNU-VISE PRODUCTS LAPEER MANUFACTURING CO.

3064 DAVISON ROAD • LAPEER, MICHIGAN

WESTERN DIV.: 422 Magnolia, Glendale, Calif. • CANADIAN DIV.: Higginson Equipt. Sales Ltd., Hamilton, Ont.

CIRCLE INFORM-A-GRAM KEY NO. 2124

GROWING PAINS



Turchan Follower Machine Company, formerly of Detroit, has moved into its new building in Inkster, Mich. Turchan manufactures hydraulic tracer controls and tracer controlled machine tools. This plant provides 20,000 sq ft of floor space to accommodate increased engineering, experimental, and manufacturing facilities. An area for demonstrations of tracer controlled attachments for all types of machine tools is also provided.

◆

Construction has begun on the $300,000 addition to the plant of **Miniature Precision Bearings, Inc.** in Keene, N. H. The new facilities will increase manufacturing space by 50%. The company produces more than 500 types and sizes of miniature ball bearings for applications in aviation instruments, guided missile components, and electronic components.

◆

The Illinois Gear & Machine Company is spending $2,000,000 for its expansion program at its South Works in Chicago. Building construction will double the size of the heavy manufacturing division. More than half of the expenditure is for heavy machine tools.

◆

Westinghouse Electric Corp. will build a new manufacturing and repair plant in Charlotte, N. C. The 24,000-sq-ft building will be equipped with a 25-ton crane and modern repair facilities to handle all types of repair work on heavy industrial and utility equipment.

◆

The SpeedWay Manufacturing Division of Thor Power Tool Co. of Chicago has begun construction in LaGrange Park, Ill., of a new $750,000 plant. This building will have more than double the space and triple the production capacity of the division's present factory in Cicero, Ill. It is scheduled for completion before the end of this year.

◆

Allied Engineering and Production Corporation, which develops prototypes of machinery for the atomic, electronic, and hydraulic industries, is moving into a new and larger building in Alameda, Calif. The modern 24,000-sq-ft building will house a staff of engineers and specialists.

Purchase of the 68,000-sq-ft plant of the **Camfield Manufacturing Company** in Grand Haven, Mich., by the **Gardner-Denver Company** has been announced. The former Camfield property adjoins the main plant of the Keller Tool Division of Gardner-Denver. It will allow future expansion for producing air tools, hoists, and other pneumatic equipment.

◆

Hamilton Standard's new 410,000-sq-ft plant at the rear of the main plant at Windsor Locks has opened. The plant houses fuel control and experimental engineering and production departments.

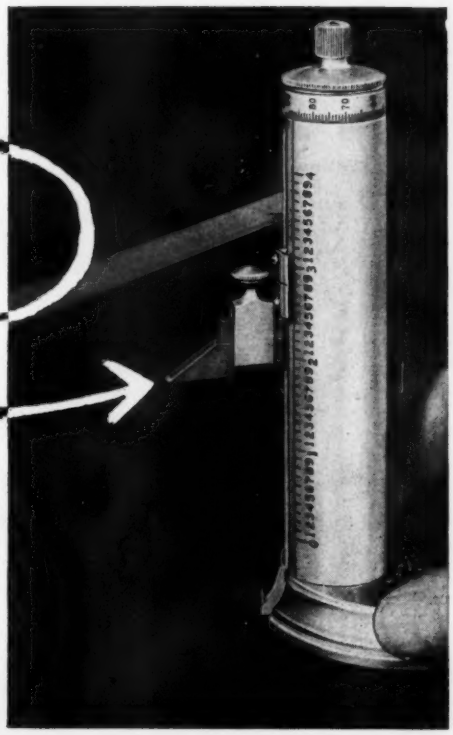
Alloy Precision Castings Company is enlarging its plant in Cleveland, which will make it possible to double the existing facilities. The company, a subsidiary of **Mercast Corporation** of New York and an affiliate of **Atlas Corporation,** produces frozen mercury investment castings based on the Mercast process.

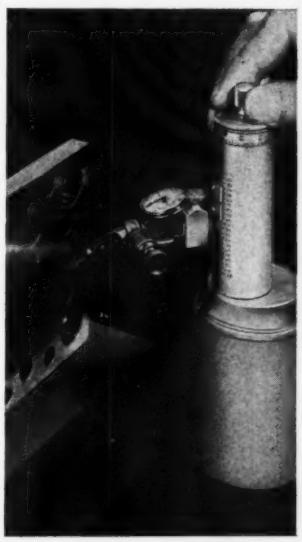
◆

Ground has been broken by **Blue M Electric Company,** manufacturers of temperature controlled equipment, for their new 12,500 sq ft expansion. This will make available a total of 37,000 sq ft for manufacturing facilities.

FOR **FAST** LAYOUT

GREIST
MICRO-HEIGHT®
GAGE





New model has 5" direct capacity —gives you 11" range with Riser

Micro-Height measures and scribes like a vernier gage. Reads **faster than your micrometer!** Measures height direct from **zero at base.** Hundredths on barrel . . . thousandths on large head that eliminates errors and **cuts reading time.**

***FAST* INSPECTION!**

Add the Greist Indicator Holder for speedy inspection—with your present dial indicator.

MICRO-HEIGHT "4" has 5" capacity (11" with Riser). Price, without scriber, only $57.
MICRO-HEIGHT "2" has 3" capacity (9" with Riser). Price, without scriber, only $36.50.

Accuracy ±.0003". Rustproof, satin-chrome finish.

Call your GREIST *distributor or write*
THE GREIST MANUFACTURING COMPANY, 489 BLAKE ST., NEW HAVEN 15, CONN.
Precision Products since 1871

CIRCLE INFORM-A-GRAM KEY NO. 213

MEN YOU SHOULD KNOW

Dr. W. H. Brandt has been named director of advanced systems engineering for the Westinghouse Sunnyvale Manufacturing Division. He will direct scientists and engineers working on special studies related to the development of handling and launching systems for the Navy's new intermediate range ballistic missile, Polaris.

◆

The new manager of Brehm Die Division of Vulcan Tool Co. is **Walter E. Callison.**

Douglas R. Beggs, former assistant to the vice president of production, has been appointed general superintendent of the Carpenter Steel Company's Reading plant. **Foster W. Evans,** formerly superintendent of production control, has become production manager. **Harold W. Miller,** who continues as head of the company's engineering department, has been given the responsibility of coordinating all engineering functions, including electrical and mechanical maintenance.

How Can Any Hack Saw Cut As Fast As a MARVEL?
Marvel
GREATER EFFECTIVE FEED PRESSURE
MARVEL Series 6, 6A, 9 and 9A Hack Saws are capable of automatically applying more than twice the feed pressure required for most hack sawing jobs. This means that MARVEL Saws can utilize the full strength and heat resistance of the modern composite hack saw blade which is designed to cut most efficiently under heavier feed pressures. MARVEL Dual Power Feed forces the blade to cut as deeply as possible and practical on every stroke—to cut-off the work in the fewest possible strokes by automatically adjusting the feed pressure in relation to the changing work resistance.
MORE CUTTING STROKES PER MINUTE
MARVEL Reciprocating Crank Lever Action, providing quick return of the saw frame on the non-cutting stroke produces 33⅓% more cutting strokes per minute than ordinary saws without increasing the peak blade velocity on the cutting stroke. Result: faster cutting-off without damage to the blade.
With far greater feed pressures automatically available, plus more cutting strokes per minute, is it any wonder that MARVEL Series 6 and 9 Hack Saws will give you faster, accurate cutting-off every time?
Write for the MARVEL Catalog and the complete story on MARVEL Metal Cutting Saws
MARVEL SAWS
ARMSTRONG-BLUM MFG. CO.
5700 BLOOMINGDALE AVE. • CHICAGO 39, ILLINOIS
MARVEL Metal Cutting SAWS
Better Machines—Better Blades
FB-1301

CIRCLE INFORM-A-GRAM KEY NO. 214

Micromatic Hone Corp. has announced **R. G. Ellis** has been named staff assistant to **William H. Harris, Jr.,** vice president and assistant general manager of the company.

◆

Appointment of **Joseph W. Eskridge** as vice president and general manager of the Special Products Division has been announced by American Motors Corp. Eskridge succeeds **Stuart G. Baits,** who retired.

◆

Durwood A. Blaisdell has been elected executive vice president of the Baird Machine Co. He assumes general management responsibility of all Baird operations.

◆

The post of O.B.I. engineering supervisor at the Hamilton plant of Clearing Machine Corp. has been assigned to **John Prendergast.**

◆

The Technical Services Division of the Alpha Molykote Corp. will be headed by **Harry S. Gerstung. Dr. Josef Gaensheimer** has been transferred from the company's basic research group in Germany to the Stanford, Conn., laboratories and will be concerned with the quality control and new product development of Molykote lubricants.

◆

Ralph M. Smith, formerly superintendent of The Timken Roller Bearing Company's Zaneville plant, has been named plant manager of that plant. Mr. Smith replaces **Elmer J. Schweitzer** who recently became managing director of Australian Timken Limited. **Norman C. Hofer,** formerly general foreman, is now superintendent and **Richard B. Gibbons,** foreman, has been made general foreman.

◆

Formerly manager of product development for Standard Pressed Steel Co., **Bennett D. Jones** has been advanced to the post of technical director in the company's Aircraft Division. **Frederick D. Fernsler** has been named manager of the nut department of the Aircraft Division. **Chester C. Lonsdale,** has been named superintendent of the Hollowell Division and will be in charge of manufacturing, packaging and shipping in the division.

◆

John R. Lenox, formerly an administrative official of Minneapolis-Honeywell Regulator Co., has been elected vice president in charge of operations of Datamatic Corp., a subsidiary of Honeywell.

MEN YOU SHOULD KNOW

Atlie Jannson, a precision tools repair specialist, has joined Precision Tool Repair Co.

◆

The appointment of **Donald F. Levleit** as general manager of Veet Industries has been announced by the company.

◆

Charles E. Huddleston has been appointed director of engineering at the Lewis Welding & Engineering Corp.

◆

Robert A. Schafer has been appointed vice president in charge of engineering of Baker Brothers, Inc.

◆

George R. Elges has been appointed plant engineer for Cadillac Motor Car Division. He replaces **L. D. Allen,** who retired.

◆

Denison Engineering Division of American Brake Shoe Co. has announced the appointment of **William F. Bohannan** as field research engineer.

◆

The new plant manager of the Gear-O-Mation Division of Michigan Tool Co. is **Felix Zawaski.** He was formerly chief engineer for the division.

◆

Directors of The Bullard Co. recently elected **E. C. Bullard,** chairman of the board and chief executive officer, and **E. P. Bullard III,** president and general manager.

◆

Paul R. Shawver has been named manager of Square D Company's Cedar Rapids, Iowa, manufacturing plant. He succeeds **C. Howard Brittenham** who has resigned.

◆

Allegheny Ludlum Steel Corp. has announced the appointment of **Dr. Theodore T. Magel** to fill the newly created position of assistant to the vice president and technical director, with responsibility for nuclear materials development.

◆

Benjamin Torrison has been appointed superintendent of the production control department at Allis-Chalmers' Terre Haute Works, succeeding **John Rehorst,** who resigned.

◆

Carl O. Larson succeeds **Hadar Wahlquist,** who is retiring, as superintendent of the Machine Division of Moore Special Tool Co., Inc. **Niles Lindstrom** has been appointed superintendent of the Tool Division, succeeding **William D. Angell,** who also is retiring.

James C. Mabe, manager of plant operations, has been elected a vice president of Chicago Pneumatic Tool Co. All manufacturing and engineering operations will be under his jurisdiction. His headquarters will continue to be at the company's home office in New York City.

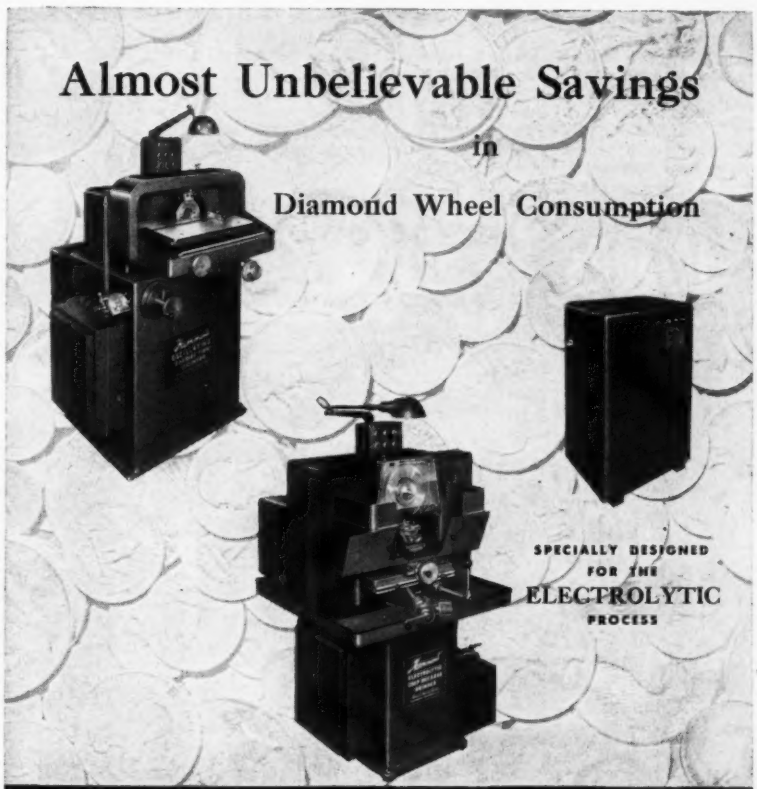
◆

Scovill Manufacturing Co. announces the appointment of **Norman J. Schaffer** as works manager of the Forging and Screw Machine Division.

Three appointments were made recently in the Stamping Division of Chrysler Corp. **George S. Aradan** was named divisional master mechanic and **John H. Davis** was named divisional chief engineer. The new manufacturing manager for the Mack Ave. plant is **Ernest W. Marchand.**

◆

The manager of the Power & Package Unit Division of Racine Hydraulics & Machinery, Inc. is **George Verhaeghe.** He was formerly chief sales engineer of the company.



...and grind easier and faster with the New Hammond Electrolytic Oscillating and Chip Breaker Grinders

The new Hammond Electrolytic Oscillating and Chip Breaker Grinders were designed primarily for use with the Anocut electrolytic grinding process. A controlled and precise method, the Electrolytic process removes stock electrochemically. It is not to be confused with electro-spark or electro-arc methods. It reduces diamond wheel consumption 80% to 90%.

Combined with electrolytic grinding, these Grinders provide a tremendous advance in grinding ease, speed and cost reduction.

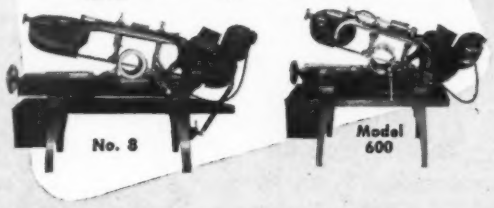
WRITE FOR FREE LITERATURE

Hammond Machinery Builders INC.

1631 DOUGLAS AVE. • KALAMAZOO, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 215

Simple Design... Rugged Construction



WELLS HORIZONTAL METAL CUTTING BAND SAWS

The simple design and rugged construction of every "Wellsaw" didn't just happen. We planned it that way! Over 30 years of specialized band saw experience and know-how is your assurance of the quality and service with each machine produced by Wells Manufacturing Corporation.

There is a Wells Saw of the right style, capacity and speed to do a better, more economical job for you. Wells Saws will deliver long, dependable service. Operating and maintenance costs are very low. See your Wells Distributor.

Wells

The Pioneers of Horizontal

METAL CUTTING BAND SAWS

WELLS MANUFACTURING CORPORATION
1940 Cedar Street

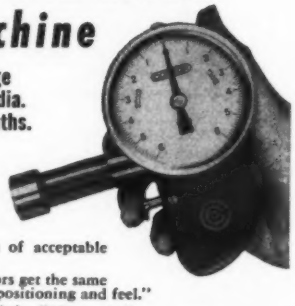
CIRCLE INFORM-A-GRAM KEY NO. 2161

Why let REJECTS reach HERE

When you can STOP MAKING rejects HERE

BY USING COMTORPLUGS *at the machine*

Precision Internal Gage for holes ⅛" to 10" dia. with tolerances in tenths.



USERS SAY:

"Tolerances actually reduced by .0002."
"Back tapers eliminated."
"Marked increase in percentage of acceptable work."
"Any number of different operators get the same reading, thanks to the automatic positioning and feel."
"Doesn't get out of order if handled a little rough."

USERS INCLUDE:

Jet engine, automatic transmission, household appliance, farm machinery, guided missile and other volume-precision plants. IT MAKES PRECISION GAGING EASY.

COMTOR COMPANY
82 Farwell St.
WALTHAM 54
MASS.

GET THE FACTS—REQUEST BULLETIN 50

CIRCLE INFORM-A-GRAM KEY NO. 2162

BOOST POWER PRESS PRODUCTION!

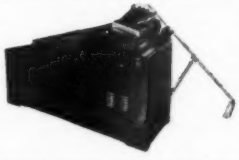
These Components Reduce Material Handling Costs, Save Floor Space and Permit Continuous Flow Operation.

AIR OPERATED SLIDE FEEDS

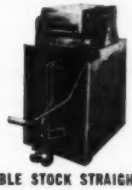
MECHANICAL SLIDE FEEDS

SMALL PARTS STRAIGHTENERS

SCRAP CHOPPERS



STOCK CRADLE AND STRAIGHTENERS



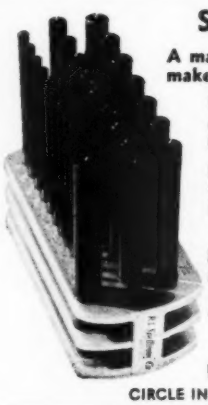
PORTABLE STOCK STRAIGHTENERS

WRITE FOR INFORMATION ON ANY OF THESE PRODUCTS TO

COOPER WEYMOUTH, INC.
600 HONEYSPOT ROAD • STRATFORD, CONN.

CIRCLE INFORM-A-GRAM KEY NO. 2163

SPELLMACO SPOTTERS



A matched set of transfer punches for toolmakers, machinists and tool cribs.

Used for transferring location of threaded, drilled and reamed holes, slugs, blanks, etc.

Precision made of finest tool steel carefully heat treated and tempered for long life. .0025 undersize to facilitate use—black oxide finish.

Set No. 3-17: 28 punches with indexed stand—sizes 3/32" to ½" by 1/64" plus hand 17/32" size—length 4⅞". PRICE only $17.90

Single size available.

R. L. SPELLMAN CO. • Urbana, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 2164

HELIOS
PRECISION DIAL CALIPER

Guaranteed Accuracy Within .001" Reading .001"

- **SPEED**
- **PRECISION**
- **DEPENDABILITY**

6"
$31.80
F.O.B. New York

Full scale reading of 5" — 6" — 8" — 10" Available. Also Foot with Scriber to convert to Vernier Height Gage.

Ask for catalog and prices of other Standard Calipers.

NEISE MODERN TOOLS

KARL A. NEISE
404 4th Ave., Dept. TP
New York 16, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 2165

The new president of Sleeper & Hartley, Inc. is **William H. Welch. Richard S. Russell** has been elected vice president in charge of production.

◆

William J. Newton is serving as engineering representative in the New England region for Huck Mfg. Co. His offices are in Framingham, Mass.

◆

James J. Clarke has been named sales manager for Ramset Fastening System, a part of Olin Mathieson Chemical Corp.

◆

Dave Levinson and **Walter Brodz** have become sales engineers in the St. Louis, Mo., area for Acme Industries, Inc.

◆

Three sales staff appointments have been disclosed by The L. S. Starrett Co. **Richard H. Chace** is serving in the San Francisco area; **Allan B. Carruth,** Atlanta, Ga., area; and **Robert J. Carney,** Los Angeles area.

◆

Everett E. Slitor, Jim Marshall, and **Herb Dartsch** have joined the sales staff of Chicago-Latrobe. They will serve the southern Ohio, Detroit, and Chicago territories, respectively.

◆

William R. Wetzel is now a member of the sales staff of Macklin Co.

◆

Lou Tuglus has become assistant sales manager of Clearing Machine Corp., division of U.S. Industries, Inc.

◆

The new sales engineer in the Pittsburgh office of Wall Colmonoy Corp. is **John R. Onders.**

◆

R. W. Selvig has taken over as sales representative in the New York and New Jersey territory for the Helicoid Gage Division of American Chain & Cable Co., Inc. His headquarters will be in New York City.

◆

Charles W. Moore has been appointed representative for the S. W. Card Division of Union Twist Drill Co. for West Virginia, Western Ohio, and part of Kentucky.

◆

Bathey Mfg. Co. announces the appointment of **Glen R. Steele** as sales manager. He will be in charge of all direct and dealer sales for both materials handling and surveying equipment.

Edward E. Nicholas has been named manager of sales engineering of the Special Products Division of The Colson Corp.

◆

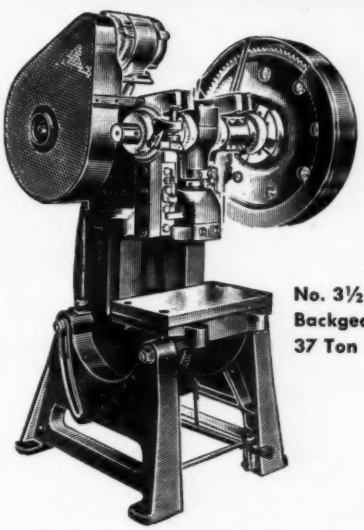
The new general sales manager of Benchmaster Mfg. Co. is **Arch O. Shafer.**

◆

Ralph A. Petersen has been appointed manager of the new Birmingham, Ala., district office of Pangborn Corp. His territory covers Alabama, Mississippi, and eastern Tennessee.

Clearing Machine Corporation has made the following changes in the sales department. Sales representative **Gail Stifler** has been transferred from Philadelphia to the New York-New England area. His offices will be in Mount Vernon, N. Y. **Carl Benson** is now operating out of the Philadelphia office as a sales engineer. The southern Ohio and West Virginia territory is now being covered by sales engineer **Jim Cavender,** and **William Rowlette** is working in the company's Detroit sales department.

Get *Extra* Production from the *Built-in* EXTRAS in PRESS-RITE Presses



No. 3½
Backgeared Model
37 Ton

Extras such as high tensile semi-steel frames with built-in reinforcement, front and rear ramway lubrication, automatic brake, non-repeat single stroke attachment and PRESS-RITE mechanical or "Air Flex" friction clutch are a few of the reasons you get *extra production* from PRESS-RITE O. B. I. Power Presses.

Perfect alignment of ram is easy to maintain through independently adjustable gibs on extra long, heavy, full vee ramways. Also available in flywheel type.

FREE Slide tonnage calculator and working stroke pressure guide plus other valuable information. Value $1.00, FREE if requested on company letterhead. Write TODAY.

For specifications on all PRESS-RITE models from 2 to 85 ton capacity write for Press-Rite catalogue No. 757.

PRESS-RITE DIVISION
of Sales Service Machine Tool Company
2351 University Avenue
St. Paul W14, Minnesota

PRESS-RITE
O. B. I.
POWER PRESSES

CIRCLE INFORM-A-GRAM KEY NO. 217

SPECIFY TOP QUALITY

DE-STA-CO

ARBOR SPACERS SHIMS and SPACING COLLARS • Arbor Spacers and Shims in 20 sizes and thicknesses from .001" to .125". Arbor Spacers furnished with standard keyway; Shims, with no keyway. Also Spacing Collars in numerous popular diameters, and in thicknesses from ⅛" to 3". Hardened and ground; edges chamfered. Furnished with standard keyway.

FEELER STOCK • Made from tempered stock, rolled to close tolerances, ½" x 25' coils packaged in transparent plastic boxes, except above .020". Strips ½" x 12", in cellophane. 27 thicknesses. All thicknesses from .001" to .032". (For use in precision fitting, checking clearances, inspection and production work.)

SHIM STOCK • Steel or brass. Selected from material rolled to precision limits, free from burrs, and protected by oil coating. Coils packed in carton for easy dispensing and protection. 15 thicknesses, .001" to .032". Sheets 6" x 12"; coils 6" x 120". Available also in two assortment packages —12 thicknesses, .001" to .015", and 15 thicknesses, .001" to .032".

DE-STA-CO

WRITE FOR Illustrated Brochure and Price List!

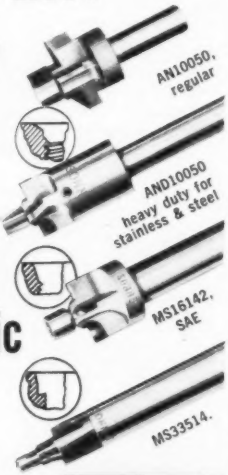
DETROIT STAMPING CO.

344 MIDLAND AVE. • DETROIT 3, MICH.

CIRCLE INFORM-A-GRAM KEY NO. 2181

IMMEDIATE DELIVERY

contour cutters for popular hydraulic ports!

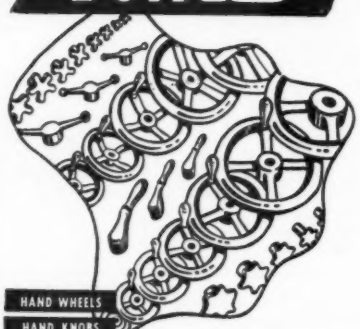


One pass completes all operations necessary to produce the port contour. Job time cut as much as ⅔! All have carbide cutting edges for long life, smooth finishes. Available in all sizes. Write for prices.

SONNET Tool and Mfg. Co.
576 North Prairie Avenue
Hawthorne
California

CIRCLE INFORM-A-GRAM KEY NO. 2182

Tomco



HAND WHEELS
HAND KNOBS
MACHINE HANDLES
HANDLES
BALL HANDLES
SPECIALTIES

Specify Tomco for long lasting dependability

A complete line of high grade hand knobs, handles, and hand wheels is available from Tomco. Immediate shipments are made from stock of standard items. Specialty items are made to your specifications.

For original equipment or replacement parts look to Tomco for quality and service.

Write for literature

Tomco PRODUCTS CO

1623 DOUGLAS AVE.
RACINE, WISCONSIN

Blank or Machined—from stock

CIRCLE INFORM-A-GRAM KEY NO. 2183

NEW BORING BAR AND THROW-AWAY INSERTS STEP UP BORING JOB

Rough boring cost per piece of an automotive component has been cut to less than one fourth of its former cost by use of a special boring bar designed to use throw-away carbide insert tools. The job was rough boring an 8" dia in ¾" thick steel clutch plates.

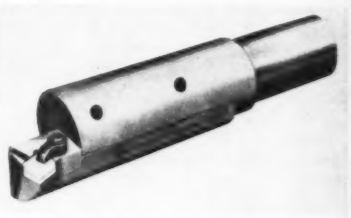


Fig. 1. This specially designed boring bar holds a standard Kendex style KSFR-16 tool for rough boring 8" dia in ¾" steel clutch plates.

This special boring bar is shown in Figure 1. The boring bar design is illustrated in Figure 2. A Kendex style KSFR-16 tool holder is shown drilled to accommodate two socket head cap screws.

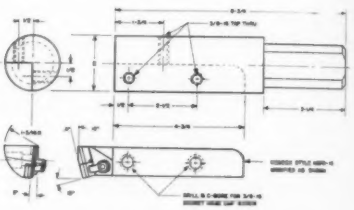


Fig. 2. A boring bar which takes advantage of the low tool costs of "throw-away" inserts in rough boring was specially designed to hold standard Kendex tool holders.

Formerly, only 12 pcs could be rough bored per tool grind, and 96 pcs per tool. Now 31 pcs are bored with each corner of a Kendex square, "turn-over" insert with 8 cutting edges, and the total is 248 pcs/insert.

Boring tools with brazed inserts cost $2.04. Seven regrinds at 23¢ each cost $1.61. Total cost was $3.65 for 96 pcs or 3.8¢/pc.

Kendex tools, made by Kennametal Inc., cost $9.90 for holder and 95¢ for each insert. Conservatively assuming that the holder can be used for only 10 inserts, the tool cost for 248 pcs would be $1.94 making a cost of 78¢/pc.

The time saving or speed-up in production, not included in the above comparison, increases savings still more. Boring was done with both tools at .011" feed, 280 sfpm (134 rpm), and 3/16" depth of cut.

PREPARES COIL STOCK FOR PRESS
New Low Cost
LIGHT-DUTY OILER-STRAIGHTENER
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Handles stock up to 3" wide, 1/16" (app.) thick
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The Genuine MAUSER VERNIER CALIPER
IS NOW MADE OF STAINLESS STEEL THROUGHOUT
AND THE FOLLOWING IMPROVEMENTS HAVE BEEN ADDED
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• SPECIALLY LONG VERNIER to read thousandths
• 3 GRADUATIONS - 1/1000" - 1/128" 1/10 mm in back
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Fourth Edition

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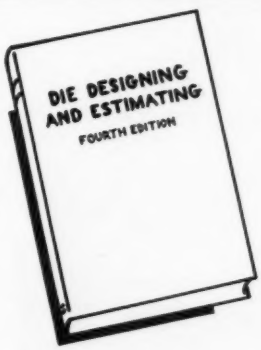

Written expressly for Die Designers, Die Engineers, Tool and Die Makers, Owners and Managers of Tool and Die Shops and Depts., Students, Apprentices and valuable, too, as a reference and refresher for the die experts who are more than qualified to write a comparable text.

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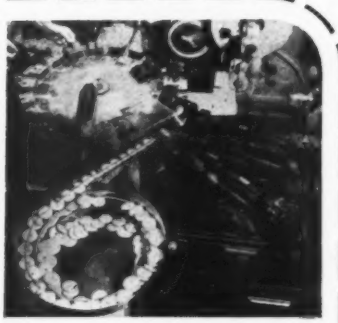
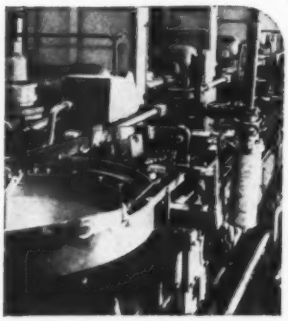
PARTS FEEDERS





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Rate of parts flow can be controlled by merely turning a dial to increase or decrease the rate of flow of parts discharge.

It emphatically increases the speed and accuracy of any production operation. Almost every kind of material may be handled — metal, wood, plastic, rubber, ceramic, glass, etc.

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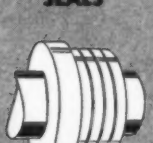

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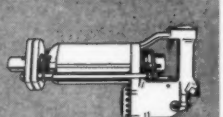

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SYNTRON COMPANY

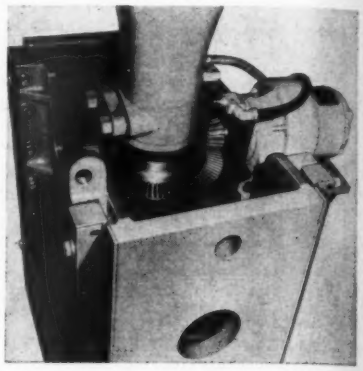
341 Lexington Avenue Homer City, Pa.

CIRCLE INFORM-A-GRAM KEY NO. 220

MOTORIZED PRESS RAM ADJUSTMENT SPEEDS DIE CHANGES

A motorized ram adjustment mechanism offers fast die set changing for short run press work.

This optional equipment on all Verson open back inclinable presses enables one press, using many die sets, to facilitate the processing of several components.



A motor mounted on the ram moves it up or down by rotating an adjusting screw. The rotation is transferred through the motor pinion to a bevel gear that is a part of the adjusting screw itself. The screw is threaded in a pitman that is connected to the ram, and a clamping cap secures the screw in the selected position.

Lock type controls are positioned at the operator's station, and limit switches can be installed.

WHEEL SPINDLE AND STEERING ARM FORGING MACHINED AS UNIT

Spindles and steering arms that are now forged in one piece are machined on a new special. It processes right and left hand spindles together so that a set for one car is completed with every cycle.

The rated capacity of this "Transfer-matic" built by The Cross Company is 288 pcs/hr at 100% efficiency.

A pushbutton operated power wrench clamps and unclamps the parts on pallet-type fixtures which are transferred through the machine's 17 stations.

Features include: a "building-block" principle which simplifies model changes; construction to JIC standards; hardened and ground ways; hydraulic feed and rapid traverse for milling, drilling, and reaming; individual lead screw feed for threading; automatic fixture cleaning unit; and complete interchangeability of all standard and special parts.

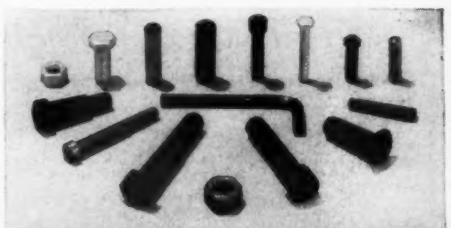
Special Process Makes CHICAGO Fasteners Stronger and Safer

These cap screws are entering a specially designed furnace. When they leave it, they are better fasteners—having received an extra margin of strength from CHICAGO's *Carbon Restoration* process.

Steel hardness depends on carbon content. In the processing of steel, some carbon is lost from the surface—leaving a thin layer of softer, weaker material. The scientifically controlled *Carbon Restoration* process replaces this carbon . . . provides uniform hardness throughout the fastener . . . assures superior resistance to fatigue, wear, shock, and vibration.

All CHICAGO socket products and heat-treated cap screws offer *Carbon Restoration* advantages. Their extra strength can mean important savings . . . longer service, reduced maintenance, and in many applications, fewer or smaller fasteners.

Over 4,000 different CHICAGO products—in a wide variety of sizes and styles—are available through your industrial distributor. He's as near as your telephone.



It pays to standardize on **CHICAGO** FASTENERS

THE CHICAGO SCREW COMPANY

ESTABLISHED 1872 • DIVISION OF STANDARD SCREW COMPANY

2701 WASHINGTON BOULEVARD, BELLWOOD, ILLINOIS

CIRCLE INFORM-A-GRAM KEY NO. 221

MANUFACTURING MEMOS

Marks Production Milestone . . .

• Manufacture of its 100,000th precision spindle was recently achieved by Ex-Cell-O Corp. of Detroit, Mich. The unit was gold plated to mark this milestone in the production of spindle assemblies for accurate machining operations, and will be retained for permanent display. The 100,000th spindle is an inbuilt motor unit of the type commonly used on surface grinders, and developing 1 hp at a synchronous speed of 3600 rpm.

Changes Name and Location . . .

• The Automatic Temperature Control Co. has changed its name as well as its location. The new title is Automatic Timing and Controls, Inc. and operations have moved to a new three-quarter million dollar plant in King of Prussia, Pa. The 74,000-sq-ft structure will double the capacity of the former Philadelphia concern, manufacturer of components for industrial automation.

Merger Announced . . .

• Miniature Precision Bearing, Inc., of Keene, N. H., has announced the acquisition through merger of the Split Ballbearing Corp. of Lebanon, N. H. Split Ballbearing Corp. has dealt largely with the aircraft, industrial, and automotive markets, while MPB's operations have been concentrated in the field of instrument components.

Institute Elects Officers . . .

• Alloy Casting Institute elected F. M. Fahrenwald president, replacing Bradley B. Evans, who retired. Mr. Fahrenwald is president and chairman of the board of Fahralloy Co. of Harvey, Ill. Paul L. McCullock, Jr., president of the Electro Alloys Div'n of the American Brake Shoe Co., Elyria, O., was elected vice president. The institute has marked 25 years of continuous metallurgical research activity.

Grants Patent License . . .

• Polymer Processes, Inc., a subsidiary of The Polymer Corp., announces the granting of a license under U. S. Patent 2,695,425 to The Barden Corp., Danbury, Conn., to manufacture ball bearing retainers from Nylastint nylon powder. The Barden Corp. has designed prototype retainers of Nylastint for special applications and will manufacture them after field tests are completed.

Consolidated Foundries & Manufacturing Co., Chicago has acquired the investment casting business of N. A. Woodworth Co. of Detroit. The latter firm will continue its manufacturing and machining operations.

◆

W. L. Huber, manager of Diamond Tool Research Co., Inc., has been elected president of the Industrial Diamond Association of America, Inc., which represents 61 member companies engaged in every phase of industrial diamond importing, fabricating, and selling. Morris Winston, vice president, is with Diamond Drill Co., of New York.

◆

Earl R. Putnam, formerly a partner in Fastcut Tool Co. of Detroit, has purchased all outstanding stock in the company. Future plans include the addition of several new items to the line of cutting tools. Among them are continuous pilot counterbores and straight shank, spiral fluted, chucking reamers. The production of special made to order cutting tools also will be expanded.

◆

Acquisition of CG Electronics Corp. of Albuquerque, N. M., by Gulton Industries, Inc., has been announced. The company will retain its corporate identity, operating as the CG Electronics Corp., a wholly-owned subsidiary of Gulton Industries, Inc., with Dr. Leslie E. K. Gulton as president. CG Electronics produces radio control equipment and printed circuits.

◆

Executive offices of Robertshaw-Fulton Control Co. are being relocated to Richmond, Va., from Greensburg, Pa.

"the job's half done before it's begun"

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Grip-Master

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Start with a speedy Grip-Master vise and fixture base.
Simply add false jaws and bushing plate.
Result . . . an accurate, precision-built, low-cost jig.

. . . so, you cut your cost of tooling

up to **75%**

MORE and more tool engineers like the engineer pictured above are turning to Heinrich Grip-Master jig and fixture bases as a simple means of cutting tooling costs. The Heinrich formula requires less designing time, less tooling time, and less material. The patented screwless design and circle-grip locking mechanism means faster setting and gripping—speedy loading and unloading for rapid fire production.

To further assist the busy tool engineer, Heinrich provides free templates to speed designing time.

The Grip-Master is available in four sizes to meet all tooling needs.

NO NEED FOR OLD FASHIONED, EXPENSIVE, CUMBERSOME JIG BOXES.
WHEN YOU USE THE GRIP-MASTER AS A JIG AND FIXTURE BASE SHOWN HERE.
positive locking guaranteed
Moves freely for instant jaw setting

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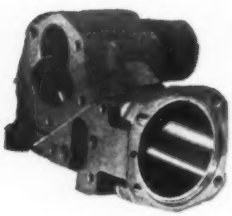
RACINE, WISCONSIN

Write for FREE catalog and templates

Why MICROHONING

Is Final Stock Removal Process For Interrupted and Blind-End Bores

To secure low-cost, final stock removal, that generates accuracy and functional surface characteristics in a variety of bore conditions, a leading manufacturer of power steering assemblies uses Microhoning. Here are details concerning types of bores and stock removal results obtained by using Micromatic "Know How"—



STEERING GEAR HOUSING—Microhoning consistently corrects cumulative inaccuracies of preceding operations—reduces scrap—permits faster boring—cuts boring tool sharpenings—lowers down-time and tool costs.

Material: Soft Malleable Iron
Bore: 3.125"D x 6.93"L (Ported bore with ¼" relief at blind end)
Stock Removal: .002"
Finish: 50 Microinches RMS
Microhoning Cycle: 18 sec.
Preceding Operation: Boring

PISTON RACK—Microhoning answers the need for a final stock removal process that generates a controlled surface finish in the bore of this leaded steel part. Microhoned surface (cross hatch) prevents oil leakage and holds to a minimum the wear of seal that operates in the bore.

Material: Leaded Steel (Rockwell 62 "C")
Bore: .875"D x 3"L
Stock Removal: .005"
Finish: 20 Microinches RMS
Microhoning Cycle: 20 sec.
Preceding Operation: Boring and H.T.

VALVE HOUSING—Microhoning consistently holds size and geometric accuracy—meets stringent surface requirements—assures alignment of four lands in bore. Thus, there is no leakage of oil around control valve which is selectively fitted to its housing.

Material: Cast Iron
Bore: .770"D x 2.18"L (Interrupted)
Stock Removal: .0025"
Tolerances: Size .0005"
Roundness .0001"
Straightness .0001"
Finish: 10 Microinches RMS
Microhoning Cycle: 12 sec.
Preceding Operation: Boring

The principles and application of Microhoning are explained in a 30-minute, 16mm, sound movie, "Progress in Precision" . . . available at your request.

☐ Please send me "Progress in Precision" in time for showing on _____ (date).
☐ Please have a Micromatic Field Engineer call.
☐ Please send Microhoning literature and case histories.

NAME _____ G
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MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE • DETROIT 38, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 224

PRODUCTION CONTROL SOCIETY TO ELECT PERMANENT OFFICERS

The American Production and Inventory Control Society, initiated six months ago by a group of production control and inventory control executives representing leading manufacturers throughout the country, has made plans to formally organize and elect permanent officers.

Arrangements chairman, Cal Schneider of the National Institute of Management, has announced that the Charter Meeting will be held October 5th at Hotel Cleveland in Cleveland, Ohio.

More than 75 companies who have charter memberships in the Society are expected to send their production control executives to participate in setting up the permanent organization, according to M. W. Maddox, president pro tem, and Manager of Production Control at Mueller Brass Company.

PRECISION FORCE GAGE IMPROVES INSPECTION AND TEST RELIABILITY

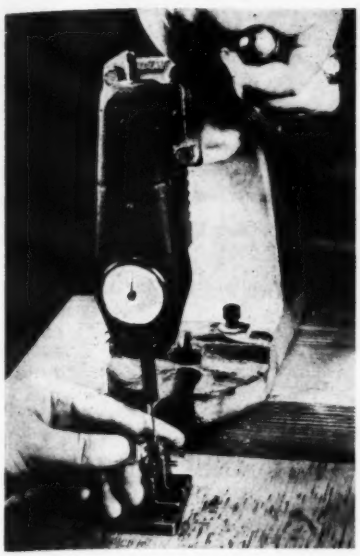
Use of a standard precision force gage in a special but simple test fixture has enabled Greist Manufacturing Co. to reduce, by more than 50%, the size of the statistical quality control sample required for testing sewing machine presser feet.

Previously the test was performed manually on a "good-or-bad" basis and relied strictly upon the judgment of the inspector. Now, by using a Hunter mechanical force gage, Greist has been able to set up a test standard, and switch from attributes to variables testing. Thus they can decrease the size of the sample, yet attain even greater test reliability.

The test determines whether or not a certain minimum axial force will dislodge the swivel pin which joins the two other pieces of the presser foot assembly. Fit of the pin must be such that it will allow the parts to swivel, yet be tight enough to stay in place during normal operation.

As shown in the photograph, the presser foot is placed in a fixture beneath the gage's compression head. The gage is mounted on a vertical rack which is lowered by depressing a hand lever. A special stiletto, mounted on the threaded stud on the head of the gage, exerts pressure upon the swivel pin as the gage comes down with the rack. The force applied to the pin is read directly upon the dial of the gage. The pin must not be dislodged by a force of less than 5 lbs.

The gage is a Model L-10, manufactured by the Hunter Spring Company. It has compression and exten-



sion heads at opposite ends of its body and thus can measure both compression and tension forces directly. Having a factory calibrated, compensated spring mechanism and a fully jewelled dial indicator the L-10 has a maximum capacity of 10 lbs and an accuracy of ±0.05 lb.

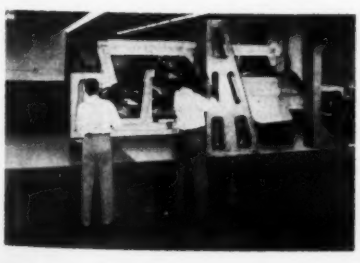
The presser foot involved in the test is the prime foot of a sewing machine and holds down cloth passing through the machine. Its two pieces must be held securely together, yet must swivel freely during operation. The test determines only the minimum pressure necessary to dislodge the pin since no pressure is excessive if the two parts of the foot can swivel freely.

PLASTIC COATED GRANITE PLATES

A special hard plastic surface over rough-finished, fine-grain granite provides low cost, precision surface plates for layout, inspection, or assembly work.

These Renaud Plastics surfaces are accurate within .002" T.I.R. across the table corners, need no special care, and will not warp, swedge, or corrode.

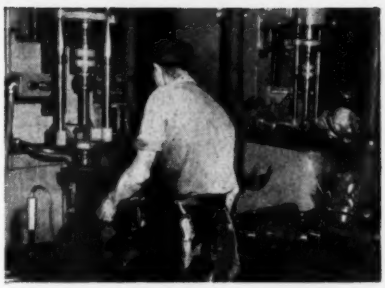
A trade-in plan replaces the usual table refinishing procedure.

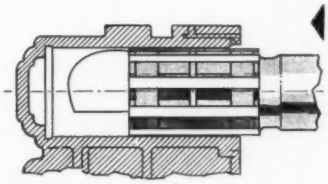


How MICROHONING

Cuts Costs—Generates Accuracy—Speeds Production of Interrupted, Blind-End Bores

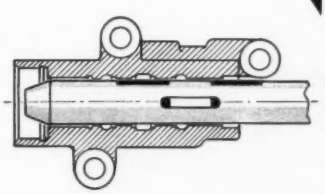
Shown are two Microhoning machines that are used in the plant of a leading manufacturer of automotive power steering assemblies. Machines are equipped with automatic stone feed and stonewear compensating mechanisms, and automatic sizing controls. A two-position rotary fixture is interlocked with machine controls for fully automatic index cycle. The following applications tell more of the "how".





STEERING GEAR HOUSING—In Microhoning the ported, blind-end bore of steering gear housing a nine-stone tool is used. At least six of nine stones are in contact with bore surface when tool passes over irregularly shaped port. Removing .002" of stock from 3.125"D x 6.93"L bore in 18 seconds, Microhoning generates final accuracies and a controlled finish of 50 microinches as specified.

PISTON RACK—In 20 seconds, Microhoning removes .005" of stock from .875"D x 3"L open end leaded steel bore of piston rack. Self-sharpening abrasives assure a consistent generation of specified surface finish of 20 microinches.



VALVE HOUSING—Microhoning tool used for final stock removal in bore of valve housing has one bank of stones and two banks of plastic guides—three stones or guides in each bank. Guides act as tool pilots and stabilizers in interrupted bore—prevent overcutting at edges of lands—assure straight bore by keeping tool aligned. Self-dressing abrasives consistently generate geometric accuracy of .0001" and surface finish of 10 microinches.

Microhoning economically removes stock—corrects cumulative inaccuracies of preceding operations—reduces scrap—permits faster boring—lowers machine tool downtime and maintenance to cut costs and speed production.

Send Coupon for Complete Information

Learn how Microhoning will give efficient stock removal, closer tolerances, accurate alignment and functional surfaces.

☐ Please have a Micromatic Field Engineer call.
☐ Please send Micromatic literature and case histories.

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TITLE_____

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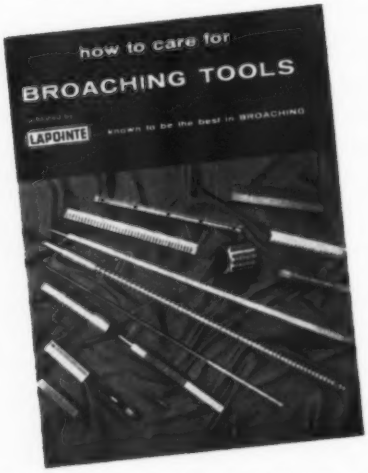
MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

SHOP AIDS

Cold Drawn Electricweld Tubing is detailed in Booklet AD189 from Jones & Laughlin Steel Corp., 3 Gateway Center, Pittsburgh 30. Its applications include hydraulic and pressure tubing, shock absorbers, pipe fittings and couplers, cylinder tubing, and ordnance parts. For other applications, details, and specifications, see the booklet supplied by the company, or —
Circle Inform-A-Gram No. C1.

Stainless Steel Sheet and Strip Products are detailed in a 32-page booklet now being distributed by Allegheny Ludlum Steel Corp., Advertising Dept., Oliver Bldg., Pittsburgh 22. The booklet has more than 20 tables presenting data on a stainless steel finder, corrosion resistance of various stainless steels, fabrication properties, and weight tables per linear foot in various widths and gauges. Included are sections on the proper selection of stainless steel grades and an industry index of applications. For your copy, contact the company, or —
Circle Inform-A-Gram No. C2.

"How to Care for Broaching Tools" is a 24-page booklet offered by The Lapointe Machine Tool Co., Hudson, Mass. It gives tips to prolong the useful life of a tool. In three separate



sections is covered the handling of broaching tools while in use on the machine, when being resharpened, and during transfer in the shop from one department to another.
Circle Inform-A-Gram No. C3.

An Enlarged "Copper & Copper-Alloy Specifications Index" has been announced by The American Brass Co., Dept. RS, Waterbury 20, Conn. Section I lists the most generally used alloys and products, complete with specifications. In Section II are found specifications in numeric order with a brief description of the material as to alloy, grade, type, temper, anneal, etc. This new edition has added Section III, which tabulates chemical compositions of all Anaconda metals covered by standard specifications. Ask for Publication B-34, 7th Edition, or —
Circle Inform-A-Gram No. C4.

A Data Chart Explaining Tolerances for Steel Tubing and Pipe was recently completed. Covered are tolerances for both seamless and welded mechanical tubing, and seamless and welded stainless steel tubing and pipe. The chart details each tolerance and gives the permissible variations in O.D., I.D., wall, ovality, and straightness. Write to Peter A. Frasse & Co., Inc., 17 Grand St., New York 13, for copies of Data Chart Sec. B No. 1, or —
Circle Inform-A-Gram No. C5.

Decimal-Binary Tables are now available from Barnes Engineering Co., 30 Commerce Rd., Stamford, Conn. This series of tables is of value to persons working with coding systems that make use of binary numbers. The tables are contained in a pocket-size folder. For copies of the folder containing the tables, contact the company, or —
Circle Inform-A-Gram No. C6.

Select-Aire Plug Gage Data Chart is now being offered by Pratt & Whitney, Inc., Gage Div'n, W. Hartford 1, Conn., to facilitate two-week delivery service. The chart lists all popular gage plug types, sizes, and specifications. The company will provide copies of the chart, or —
Circle Inform-A-Gram No. C7.

A Conversion Chart for Hardness Values has been released by The Torsion Balance Co., N. J. It contains conversion data for Rockwell tests and other hardness scales. In addition, the chart also has tables for cylindrical corrections. For your copy, contact the company, or —
Circle Inform-A-Gram No. C8.

Gage Laboratory Instruments and Services are detailed in a catalog published by The Sheffield Corp., Dept. 700, Dayton 1, O. It features specifications, instructions, and a layout guide explaining how to set up

gage laboratories to meet requirements for closer and more convenient control of parts measurement standards. Outlined are the functions of a plant gage laboratory. Copies of Catalog IN-1-57 are supplied by the company, or —
Circle Inform-A-Gram No. C9.

Metal Spinning is detailed in a booklet from Phoenix Products Co., Metal Spinning Div'n, 4715 N. 27th St., Milwaukee 9. It tells what Phoenixspinning is and how it helps make better, lower-cost products. In addition, the booklet shows the many shapes and variations possible. Included are sections giving designers' tips, showing how some typical Phoenixspinnings are made, and picturing typical parts. For complete details, see the booklet issued by the company, or —
Circle Inform-A-Gram No. C10.

Physical Properties, Applications, and Shape Availability of four wrought high-temperature alloys are listed in Booklet DB-52-250 from Westinghouse Electric Corp., P.O. Box 2099, Pittsburgh 30. It includes Discaloy, K42B, Refractaloy 26, and Refractaloy 70. Also covered are the company's facilities for hot forging, cold forming, machining, welding, and heat treatment of these alloys.
Circle Inform-A-Gram No. C11.

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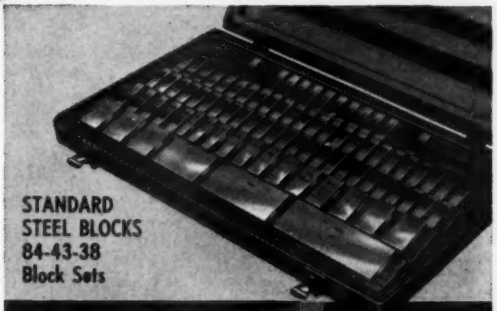
Insure the Accuracy Essential To Mass Precision Production

Making Webber Gage Blocks is a science—a combination of human skill and the world's finest mechanical and laboratory equipment, both highly specialized. Only with such a combination can gage blocks be made to meet the high standards which Webber steadfastly maintains. Webber can fill your every gage block need, with the most complete line of gage blocks and related accessories.



STANDARD STEEL BLOCKS 84-43-38 Block Sets

"THIN BLOCK" Gage Set 30 Blocks

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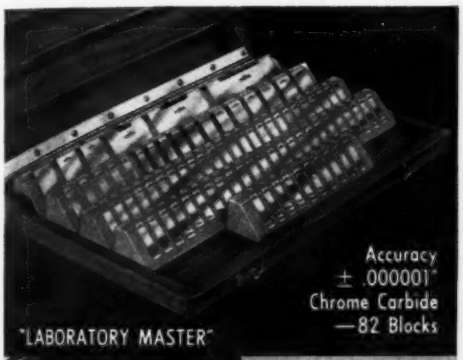
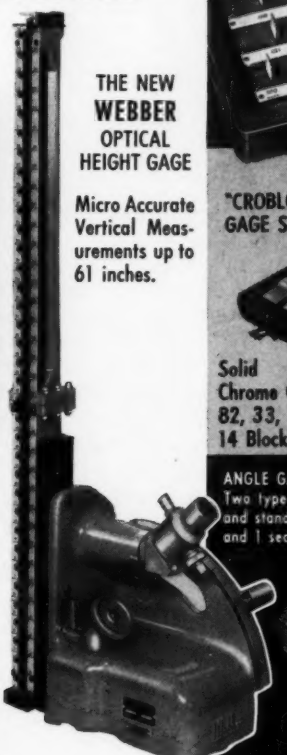
Solid Chrome Carbide 82, 33, 36 and 14 Block Sets



Accuracy ± .000001" Chrome Carbide —82 Blocks

"LABORATORY MASTER"

HEAVY DUTY GAGE SET 84 Blocks



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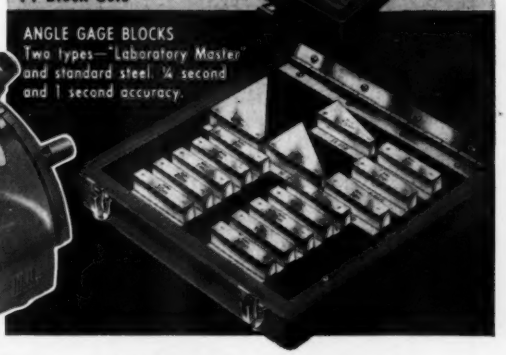
Micro Accurate Vertical Measurements up to 61 inches.



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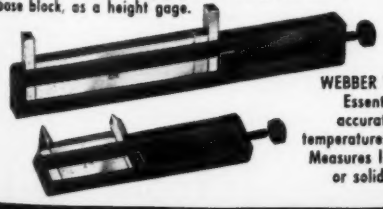

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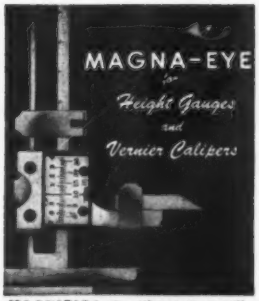

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Drill breakage and a means for increasing production was an ever present problem, since the method in use was producing only 125 pcs/hr and drill breakage was very high due to the hard stringy metal.

A special automatic drill unit was installed in an attempt to solve these two problems. This special unit, with all operating and control mechanisms built in, was set up in place of the standard head on the drill press regularly used for this work. To complete the setup a cycle timer and unloader were added. A special mounting bracket was used to secure the new drill head to the standard drill press column.

It was found that more accurately controlled precision feeds and speeds were possible with the new drill head, and that these new production results were achieved: no drill breakage; 333 pcs/hr — 2½ times former production; and lower unit cost.

This drill head is Dumore's automatic drill unit, series 24. It is a completely new and different production tool designed for single or multiple operations where versatility and flexibility are necessary to meet varying conditions and frequent change-overs of diversified manufacturing. It can be moved quickly and easily to numerous other operations with minimum time loss.

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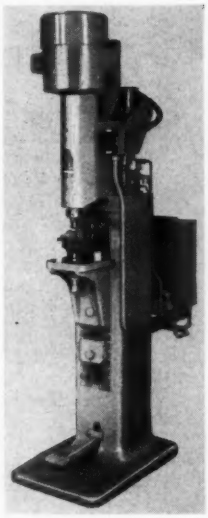

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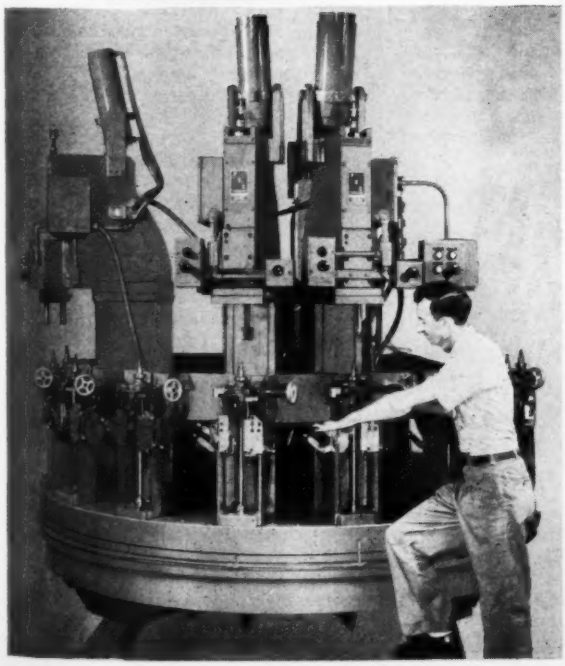
Rivet Spinner with 2" stroke and ½" Dia. rivet capacity in steel. Head only available for special machine application.



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procedure. The company designs, engineers, and installs the complete fire protection system and provides for regular inspection and maintenance. Write to the company for your copy of Bulletin 78, or —
Circle Inform-A-Gram No. F1.

An All-Transistor Home Intercom-Radio System has been announced by Talk-A-Phone Co. Fully transistorized, the system consumes little electricity, uses no tubes, and emits no heat. Among its features are, outside doors can be answered from any room; conversations can be held between rooms; and radio programs follow the listener throughout the house. The systems can be flush-mounted or surface-mounted. For more information write to Talk-A-Phone Co., 1512 S. Pulaski, Chicago 23, or —
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Engineered to Print and Develop 97% of all cut sheet reproductions is the 26 in, 75 ft/min, 100 w/in Arrow automatic dry process whiteprinter. An automatic unidirectional separator is featured. Bulletin 57A1 is available from P&H Sales Corp., 5640 N. Western Ave., Chicago 45, or—**Circle Inform-A-Gram No. F3.**

A Free Set of Miniature Plastic Storage Racks are offered by Jarke Mfg. Co. They are 8-to-1 scale models of Jarke Mini-Module prefabricated stock storage racks. When planning or revising storage of stock, determine the most efficient storage method before actually rearranging the stock room itself. For your complete set write to Jarke Mfg. Co., 1203 Balmoral Ave., Chicago 40, or—
Circle Inform-A-Gram No. F4.

Permacoustic, an Acoustical Ceiling Unit, is non-combustible and available with a fissured or striated surface. It is furnished with beveled edges; square edges, kerfed for leveling splines; and kerfed and cutback for metal suspension systems. A catalog, "Sound Control", illustrates construction and installation methods, and is issued by Johns-Manville, 22 E. 40th St., New York 16, or —
Circle Inform-A-Gram No. F5.

An Improved Book Photocopy Machine, combining exposer and printer in a single unit, is the duplex book copier. It makes black on white copies in seconds under any lighting conditions of any original written or printed page, either single sheets or pages from books, without loss of margin. Information is available from Copease Corp., 425 Park Ave., New York 22, N. Y., or —
Circle Inform-A-Gram No. F6.

SoundScriber Portable 200, designed primarily for the traveling businessman, is light, small, and compact. It weighs only 6 lbs and contains the microphone, power cord,

and a supply of 15-min discs. Another feature, the automatic volume control, automatically levels voice volume. Leaflets are prepared by The SoundScriber Corp., 146 Munson St., New Haven 9, Conn., or —
Circle Inform-A-Gram No. F7.

Cut Costs, Reduce Errors, and Increase Efficiency through sound conditioning. The ways to control noise using sound absorbing materials are described in "Your Office . . . Keep it Quiet." Acoustical products absorb sound waves that strike their

porous surfaces, and prevents them from reflecting back into the room. This paneling can be obtained in several types of material to fit every need. For more information write to National Gypsum Co., Buffalo 2, N. Y., or —
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The Basic Methods of Securing Money for Business are compared, and an actual five-year experience of one company is worked out in tabular and graphic form. This booklet, "Working Funds for Industry", is primarily of interest to financial and general management executives. The booklet is issued by Walter E. Heller & Co., 105 W. Adams St., Chicago, or—**Circle Inform-A-Gram No. F9.**

A Wireless Signalling System with pocket-size receivers is described in a brochure published by Auth Electric Co., Inc., Long Island City 1, N. Y. Pajar operates on audio-frequency impulses which are radiated inductively from antenna and picked up by the individual receivers. No license is required for its installation and operation. Two Pajar systems, non-automatic and automatic, provide a choice for small establishments with limited key personnel, and large establishments with many roving executives. Copies of Brochure 20 may be obtained from the company, or —
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Q

Saving all you can on

Production Bronze Castings?

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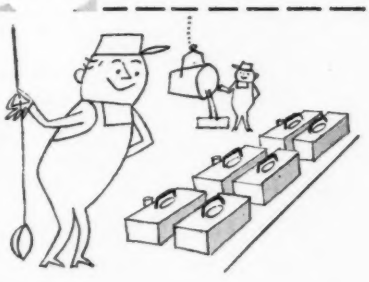

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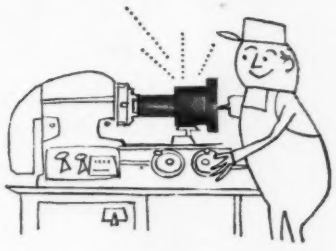

A

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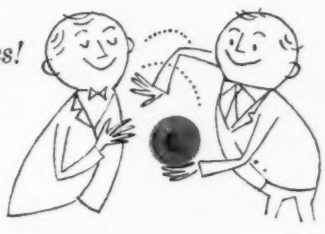
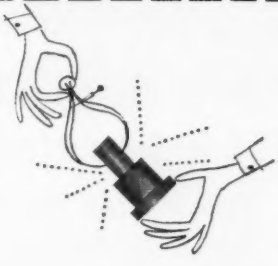
Smoother cast surfaces!
Often, smooth enough to use as is.

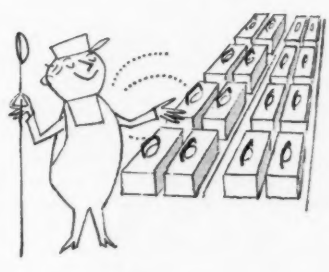


Closer tolerances!
Most castings held to ±.015 — favorable shapes, ±.010.



Less machining!
In some cases, finishing operations are eliminated.

Lower cost!
High-speed, semi-automatic mold production means foundry economy.



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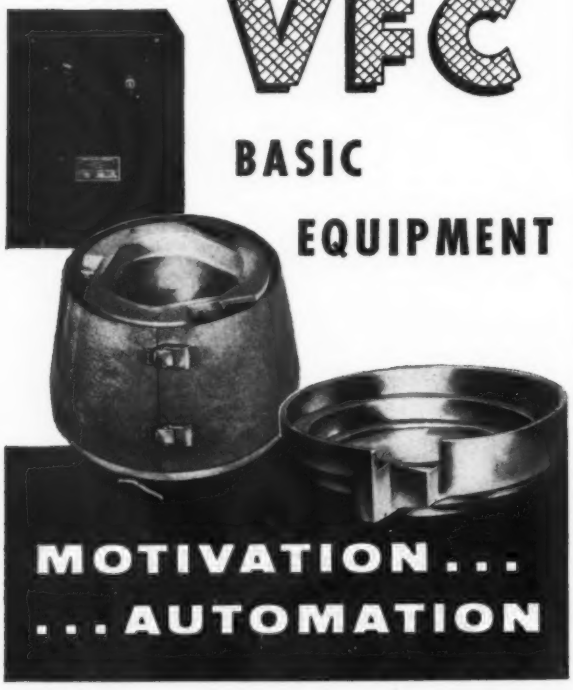

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NOW SEE THE SOUND OF RUNNING GEARS ON A LARGE METER

On Gear Speeder tests, Sperry Bearing Tester provides direct *meter reading* of sound level. Simple to use, easy to mount directly on machine.

With SPERRY BEARING TESTER, *you can:*
Cut inspection costs • Insure uniform quality • Increase inspection rate
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Lightweight, easily portable, the Sperry Bearing Tester is a versatile tool for use in preventive maintenance to pin-point machine wear, as well as on the production line to assure precision fit of mating parts.

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EXPERIMENTAL AND PRODUCTION WORK RUN ON SAME MACHINE SETUP

An ingenious adaptation of machinery and attachments has enabled a small contract tool shop to do both production and experimental work on the same machine tool.

Ray Johnson, of Ray Johnson Associates, has coupled a Howe and Fant turret drilling attachment to his Bridgeport miller and developed a tooling unit so flexible that it has given a second dimension to his business. He makes precision parts for Microphase Corp., developer and manufacturer of VHF and microwave filters for aircraft electronic systems.

This development program requires that Johnson continually manufacture these parts on an experimental run basis, involving as few as 10 units. Once a design has been approved, however, production of from 300 to 900 units is required. Despite this range in work, he is able to handle both types profitably. The turret drilling attachment is the answer. In addition to its normal work, the miller with the attachment is capable of precision drilling, reaming, tapping and counterboring from the same spindle and without removing the work from the fixture until a given hole is finished.

The aluminum parts required by Microphase often consist of six or more holes in a straight line pattern with as many different diameters. It is necessary to hold space tolerances to ±0.001" from hole center to hole center.

The output of these pieces has been increased more than three times the number obtainable before the turret attachment was added. Without the attachment, it would be necessary to change the tool for each operation on each hole.

Accuracy of alignment of the work and the spindle plus the rigidity offered by the work-holding fixture do away with a need for jigs specially built to hold the work. If jigs were required, Johnson points out,

. . . *Continued on page 35*

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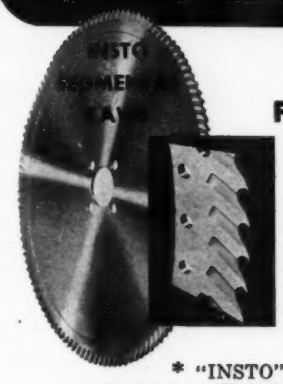

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* "INSTO" segmental Saws are produced in Sheffield, England by Firth Brown Tools, Ltd., an internationally famous name in metalworking. They are serviced in Cleveland in Donley's modern saw shop. Send today for FREE BOOKLET on "Sharpening and Repairing Cold Saws".

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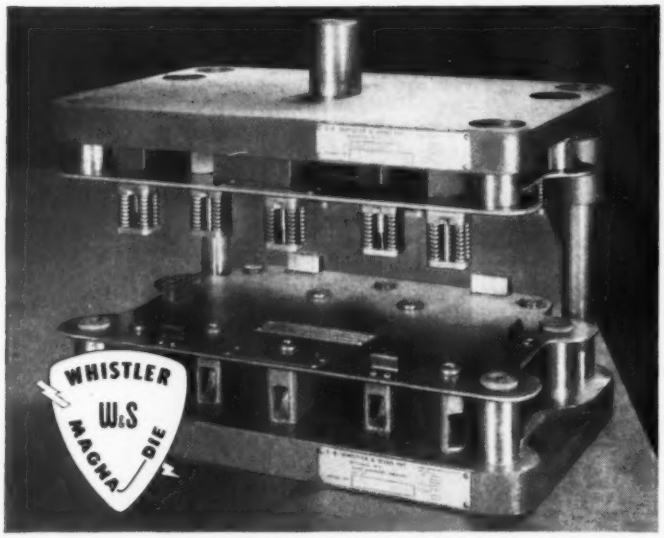
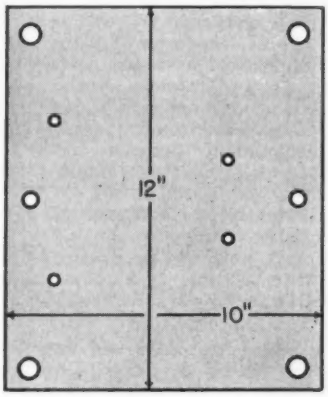
Whistler Magna-Dies open the way to big savings

Over $2500 saved on these four typical jobs... Here's a specific example showing how Whistler Magnetic Perforating Dies are used and re-used to push die costs down to a rock bottom low:

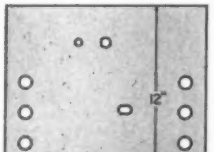




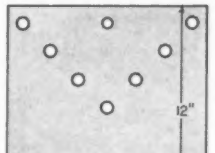
4 holes 1/2" dia.
2 holes 3/8" dia.
4 holes 3/16" dia.
Dimensional tolerance ± .0005"

$106 SAVED ON JOB NO. 1... EVEN INITIAL INVESTMENT IS LESS

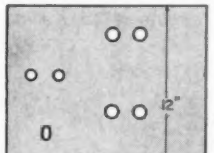
This Whistler Magna-Die unit includes a 12" x 14" die set, 10 punch and 10 die retainers, 10 punches, 10 die bushings, 10 strippers, 3 gages and one set of templets. The complete price with templets jig bored and gages mounted for producing the 10-hole part shown above: $819.00. The approximate cost of a custom die to do the same job: $925.00. From the very start, you start to save with a Whistler Magna-Die.



8 holes 1/2" dia. 2 holes 3/16" dia.
2 holes 3/8" dia.
1 oval hole 3/8" x 1/2"
Dimensional tolerance ± .0005"



1 hole 31/32" dia. 1 hole 3/8" dia.
7 holes 1/2" dia. 2 holes 3/16" dia.
1 oval hole 3/8" x 1/2"
Dimensional tolerance ± .0005"



6 holes 1/2" dia. 4 holes 3/16" dia.
2 holes 3/8" dia.
1 oval hole 3/8" x 1/2"
Dimensional tolerance ± .0005"

EACH JOB CAN BE RE-RUN AT ADDED SAVINGS, TOO!

Punch and die parts can be quickly re-assembled to re-run any one of these four jobs. All it takes is approximately 10 minutes for press changeover. Whistler Magna-Dies cut downtime and remove production bottlenecks by avoiding the extra time required to obtain custom dies. They can be used on practically any press with a minimum shut height of 9½" for perforating materials up to and including ¼" mild steel.

$710 SAVED ON JOB NO. 2

All of the original punch and die parts (with the exception of 2 punches, 2 bushings and 2 strippers) are re-used here. The additional tooling required, plus bored templets with gages mounted, cost $389.79. The approximate cost of a custom die to produce this part: $1100. *Savings pile up with each succeeding job... $816 so far.*

$793 SAVED ON JOB NO. 3

Through the use of another punch and die retainer unit, a 31/32" punch, die bushing and stripper plus a new set of bored templets with gages, this part is produced at a die cost of $246.81. In this case, the cost of a custom die would amount to approximately $1040.00. *Savings now reach $1609.*

$925 SAVED ON JOB NO. 4

As more Whistler punch and die parts are accumulated, die costs for each succeeding job usually go down even further. Here, for example, only a new set of templets, jig bored to the 13-hole pattern, is needed. The cost: $163.55. A custom die for this job would run approximately $1089.00. Total savings for these first 4 jobs alone amount to approx. $2535.

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. . . Work from page 233

the entire operation of both production and experimental work would be economically impossible.

A change of tooling can be effected in just a few minutes, and even an apprentice machine operator can run production once the tool has been set up.

Ray Johnson conceived the idea for coupling two machines because he had helped in the production of the experimental models of the turret drilling attachment some years ago. Realizing his need for the production qualities of the drilling attachment, he ingeniously tried it out on the Bridgeport miller and came up with an answer that's been paying off ever since.

MANIFOLDS MACHINED FROM ROUGH CASTING TO FINISHED PART

A new segmented transfer machine line machines automotive engine intake manifolds complete from rough casting to finished part. Either two or four-barrel carburetor manifolds can be fed into the line at random. Built-in sensing devices automatically shift heads at three stations to provide the required machining operations and no idle stations are necessary.

The line, built by Snyder Tool & Engineering Co., produces parts at a new rate of 136 manifolds per hour and is actually three individual transfer machines that add up to a total length of 230'. To put the processing line in the required 175' long factory space the two, 29-station, 72' transfer milling machine are placed in parallel and feed their output through automation devices to a third 32-station, 86" transfer drilling machine.

Snyder standard machining units with hardened and ground ways are utilized throughout the machines. Each of the milling machines has 6 standard way-type machining units powered by standard external hydraulic power units, and 8 standard self-contained machining units. The drilling machine has 18 standard self-contained units and 11 way-type machining units.

All tapping spindles in the three transfer machines have individual lead-screw drives. Automatic lubricating systems are provided. Each individual segmented machine has its own control panel and is capable of individual operation. Walking-beam type transfer mechanisms move the manifolds through the three machines. The entire machining line is hydraulically-operated and electrically-controlled with JIC standard components.

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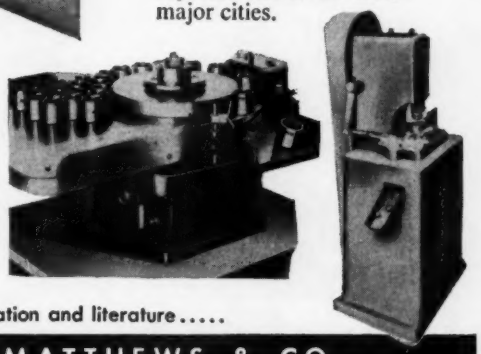

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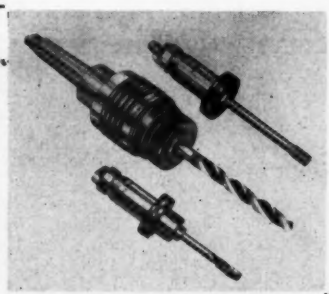

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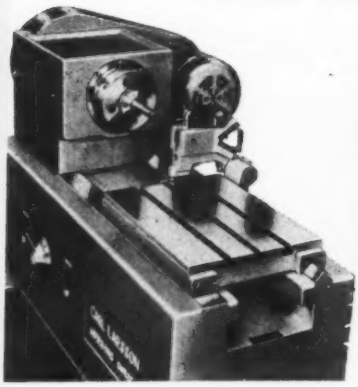

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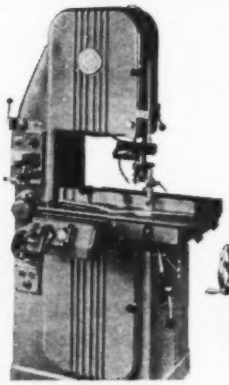

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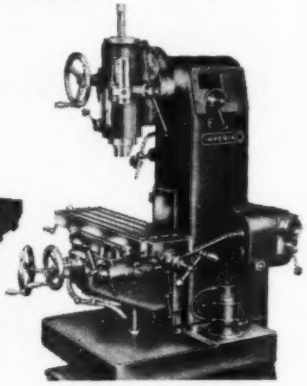

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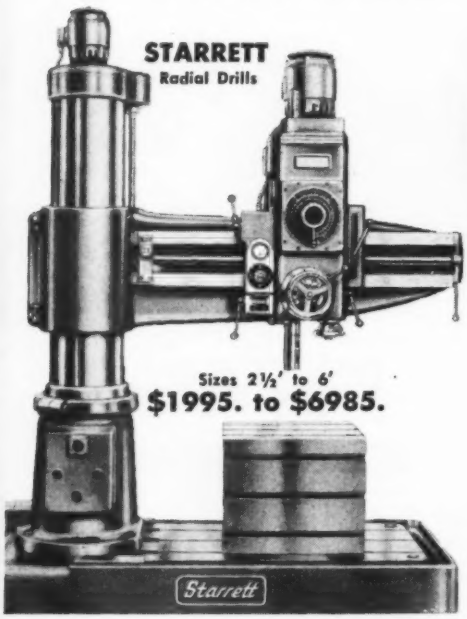

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WHEEL RIM FORMING PERFORMED ON THREE UNIT AUTOMATION LINE

An improved wheel rim forming method has been developed and the equipment installed in one of the large automobile plants. The unit is La Salle Tool's "Wheel Rim-amatic", designed so as to provide continuous automation.

The self-contained unit consists of three electrically interlocked forming machines, completely wired, with automatic load and unload mechanisms, and many built-in safety features.

The following operations take place before the rims are fed into the automation line: strip stock is run through a cutoff, hoop forming and welding machine; the weld is trimmed; and the initial "partial" form is pressed.

As a rim is started through the forming machines, it is guided through a gravity chute, and checked for proper position (left or right) as it approaches the load station.

When the rim reaches the load station, a signal energizes the "feed forming machine mechanism", and the rim is indexed to a position in front of the form roll. Next, the fixture and the rim are moved, so as to load the rim over the lower form roll. The lower form roll then raises to engage the upper roll and perform the forming operation. A guide mechanism maintains perfect wheel alignment while the rim is being precision roll formed. The lower form roll then lowers the rim into the fixture, and the fixture is moved out to its index position. The fixture then indexes, and the formed rim is ejected into a chute leading to the next forming machine in the unit. At the time of ejection, the next rim is being formed in the machine.

This series of operations is repeated automatically in the second and third forming machines.

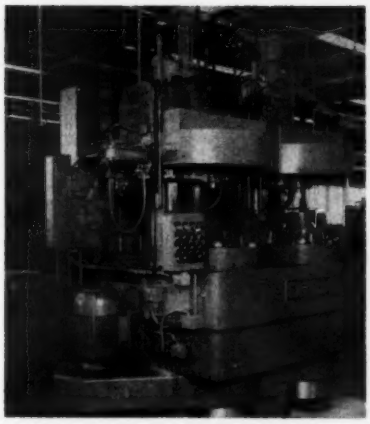
A LaSalle type shuttle transfer mechanism automatically moves the rims to the load position on the final sizing press — from a vertical plane in the third forming machine, to a horizontal plane in the final sizing press.

TRANSMISSION OUTPUT INCREASED BY THREE PHASE BORING

Production of aluminum torque converter housings for automatic transmissions has been increased by one of the Big Three automakers by the use of three 2-station vertical boring machines.

The machines, built by the Ex-Cell-O Corporation, are arranged so that the first and second machining phases are performed on machines 1 and 2. The third phase is done on machine 3 with both stations performing the same operation. The two stations of each machine are operated simultaneously but are independently controlled.

During phase one, the face of the transmission end of the housing is semifinished. Phase two semifinishes and finishes the face of the engine end, phase three finishes the face, and bores and chamfers the transmission end. The housings are secured by air-operated fixtures during all phases.



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TOOLING & PRODUCTION Magazine

The number of subjects in which T&P's editors present material in just a few issues adds up very rapidly. Most articles are of lasting interest and have future reference value in solving tooling and production problems.

This cumulative index will build up progressively during each calendar year. Each issue will carry a cumulative index of material contained in all previous issues of the same year, with each January issue carrying the complete index of the twelve issues of the previous year.

We suggest you see to it that your copies of T&P are retained for future reference so you can get the full benefit of this new, unique and useful index.

The Publisher

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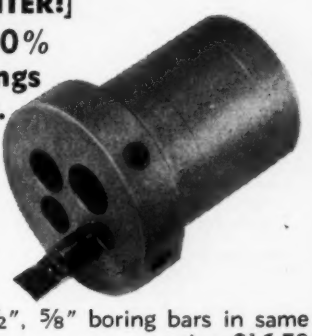

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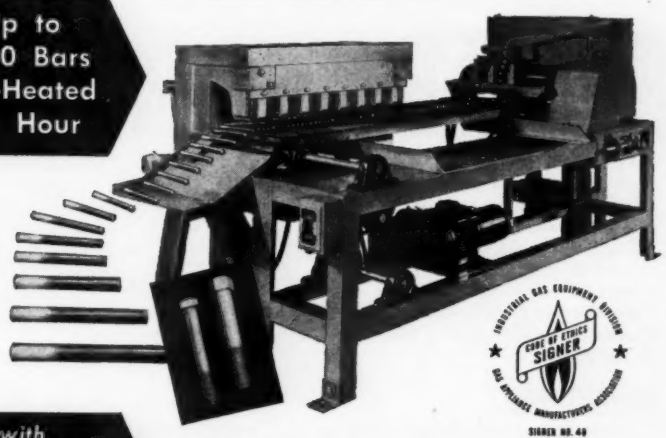

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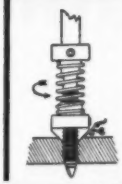

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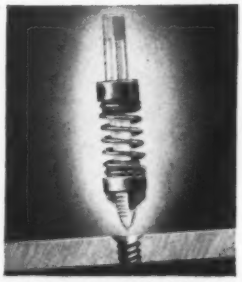

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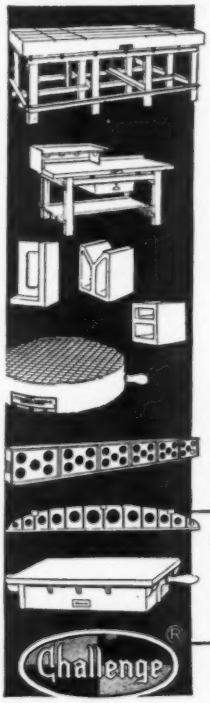

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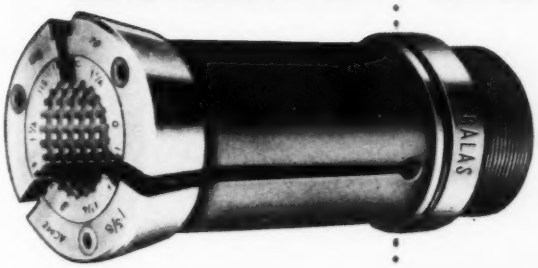

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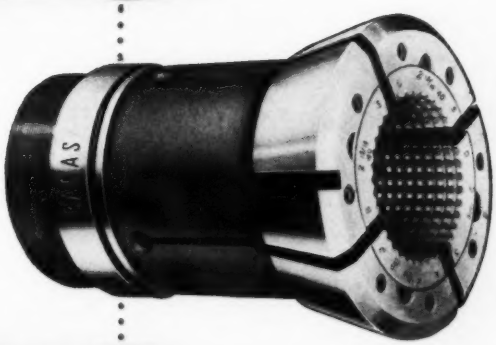

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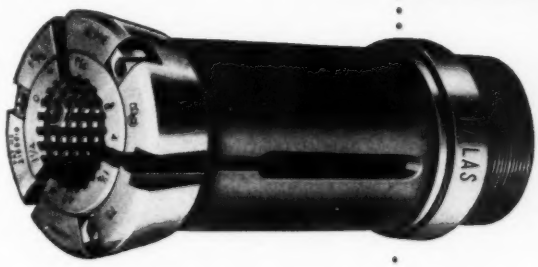

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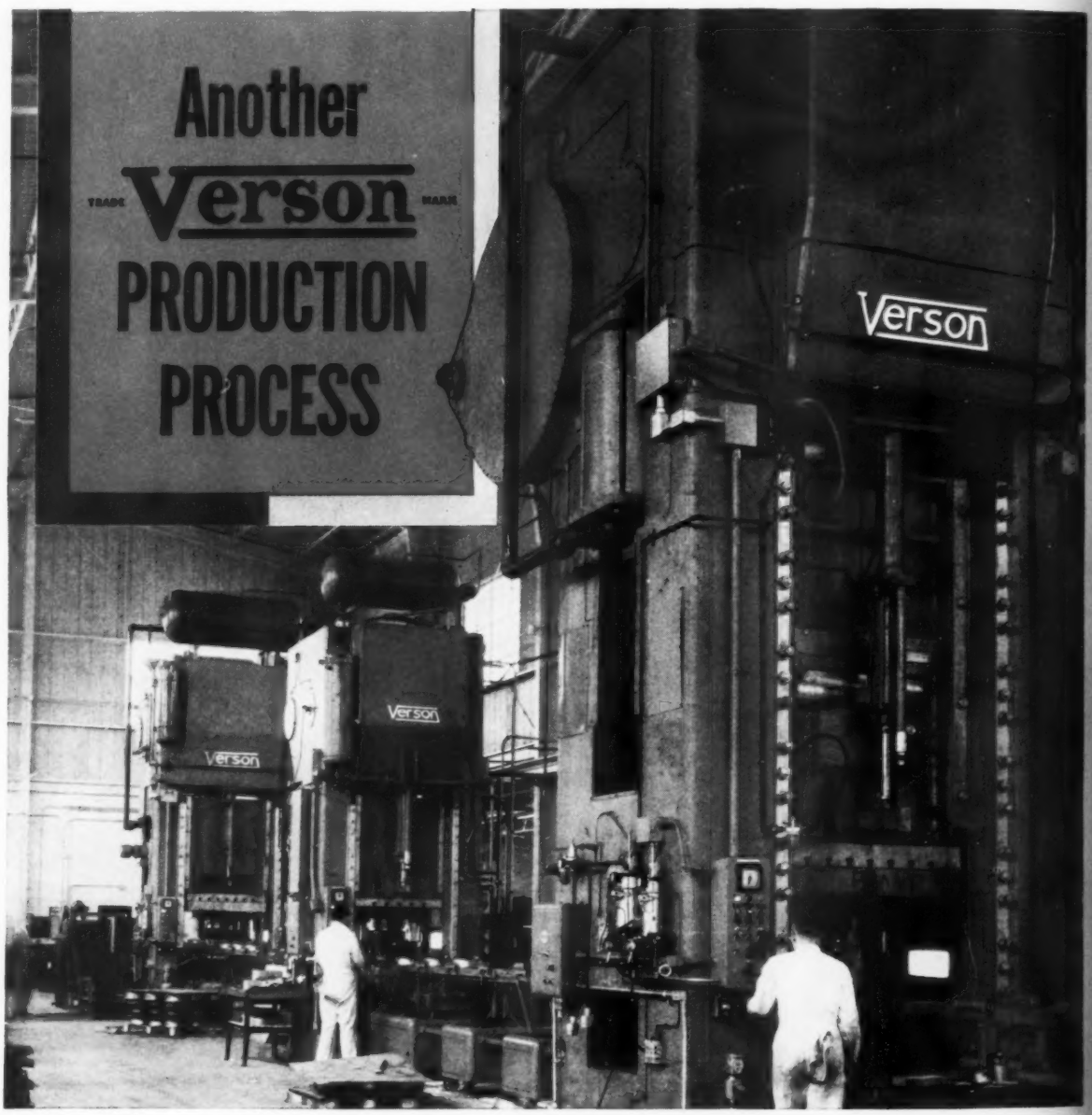

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